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THE AMERICAN
JOURNAL OF PHARMACY

Vol. 105 June, 1933 No. 6

EDITORIAL

THE PHYSICIAN AND THE PHARMACIST

A PHYSICIAN who is also a pharmacist and who for many years taught materia medica at a college for pharmacists is asked to afford pharmacists some idea as to what physicians would desire to learn from them.

To begin with, the physician must establish a diagnosis in each case as patients present themselves. Once the diagnosis is established the next problem of the physician is to attempt to cure, or at least to comfort the patient where cure is impossible. Here is where therapeutics becomes of the utmost importance. The wider the physician's therapeutic knowledge, the better served will be the patient.

Let us pause for a moment to see how and when the physician obtains his knowledge of materia medica and therapeutics, and what influences him in changing his viewpoint as to therapy.

In the medical schools the undergraduate obtains a general idea of materia medica, some general facts regarding pharmacy, and occasionally an opportunity to make a pill or potion. Later, general therapeutics is taught, together with the pharmacological action of drugs. The medical student rarely has an opportunity of actual prescribing for sick patients and hence he leaves the medical school with a general knowledge of the names and presumable indications for prescribing drugs, but without any practical experience.

After graduation, hospital experience is required, and during his interneship the interne again meets with conditions that prohibit a thorough knowledge of prescription writing. In most hospitals it is customary for the treatment to be ordered on hospital charts and in individual doses, or in sufficient doses to meet any given indication. Often one or more remedies may be combined. However, it is not the physician, but the nurse, who usually gives the medication.

Moreover, standard formulas are often used in hospitals for routine treatment and these preparations are often dispensed by number. The same general practice is often used in the dispensaries. Hence the resident physician completes his hospital experience, trained thoroughly in the art of diagnosis and with a general knowl-

edge of treatment, yet enters the actual practice of medicine with a meager understanding of the art of prescribing medication in its most desirable, efficacious and best form.

Of course, the physician will know the important sedatives, laxatives, heart drugs, diuretics, etc., but the most suitable method for their combination in prescriptions is often another story. In addition, the various remedies that may be used interchangeably in a given therapeutic group often escapes the young physician, while a knowledge of the U. S. P. and N. F. preparations remains ancient history.

The physician now enters medical practice with this preparation and he soon finds himself face to face with the necessity of acquiring more skill in prescribing for his patients. If this skill is not acquired by constant practice, the physician takes the course of least resistance and falls into the habit of prescribing the many solicited proprietary remedies which fill the pharmacists' shelves.

There is another very important viewpoint that has greatly influenced modern therapeutics and has indeed been influential in changing the belief in the efficacy of drugs. With the advance of modern medicine, as evidenced by the development of bacteriology, biochemistry, pathology and allied sciences, the physician has seen the evolution of the causes of many diseases. Thus isolation of the diphtheria germ, producing diphtheria, the meningococcus, causing meningitis, etc., has opened up a field of research resulting in the production of specific remedies for these diseases.

As a consequence of this advance, modern medicine has produced specific sera which are curative. Where specifics are not available, diseases may be presented by the inoculation with various vaccines. By this means diseases as typhoid fever are prevented by inoculation of typhoid vaccine, and diphtheria by inoculation of toxin antitoxin, etc.

Furthermore, malaria has yielded to its specific, namely quinine, while amebic dysentery has yielded to its specific, emetine.

Suffice it to say that many physicians, therefore, have learned to expect drugs or remedies to be of a specific curative nature and unfortunately have lost faith in those remedies, useful and helpful in relieving symptoms of diseases, for which we have no specifics. The pains and aches in many diseases that even have a specific for their cure, require additional medication and it is here also that additional therapy should not be lost sight of.

It will be seen from this brief resume of the physician's preparation for prescription writing and choice of remedies, together with his viewpoint as to the desire for specifics, that the pharmacist has a golden opportunity with the physician.

What the doctor really wants to know, therefore, is a list of those drugs and remedies, old and new, official and perhaps unofficial, that have been proven to have therapeutic merit. Furthermore, he would like to know the various drugs that could be used interchangeably in a given therapeutic class, where, perhaps, one drug may be nauseating and undesirable, and another could be substituted with satisfactory therapeutic effect. The doctor would also like to know the most desirable form in which to prescribe certain remedies; that is, whether a liquid, capsule, powder, or suppository would be most satisfactory. Moreover, the doctor would like to know how to avoid occasional chemical incompatibility and also possible unsightliness of a remedy.

In addition, it may be suggested that large quantities of medicine are often prescribed where only a few doses are necessary. This could be avoided by advice as to judicious prescribing. Then again, there is an opportunity for the pharmacist to inform the physician on the matter of the various endocrines; first, as to U. S. P. preparations, and secondly, as to the best available brands that are not official.

Many busy physicians may not have had an opportunity of culling from the literature the more recently discovered remedies. A list of these, with their dosage and ideal methods for prescribing, would be appreciated by these physicians. In this group of remedies one may mention preparations like insulin, parathormone, dextrose for intravenous injection, various calcium preparations, liver solution for the control of anemias, to say nothing of the various specific sera and vaccines.

It is certain that the physician would indeed welcome any information of this sort by the well-informed pharmacist, despite the traditional beliefs that the physician, high and mighty, becomes indignant when the pharmacist, of necessity or otherwise, must confer with him relative to a prescription. May I, in behalf of physicians of my acquaintance, assure you that most physicians, at all times, are highly appreciative of receiving this consultation from the specialist, the prescription pharmacist, who is good enough to act as a safety check on the medical profession in this regard.

And finally, may I add that I believe that systematized and periodic information along the lines that I have mentioned, presented to the practicing physician with emphasis on the therapeutic merits of the U. S. P. and N. F. preparations and those accepted non-official remedies, would be welcome propaganda which would be beneficial, not only to the pharmacist, but also to the physician and the patient.

Mitchell Bernstein, P. D., M. D.

BINDING UP WOUNDS

WHENEVER primeval man was maimed, instinctively he found a way to care for his wounds. Every step in man's progress has brought new forms of injury. The wagon, the engine, the motor, the machine, the aeroplane, electricity—and the now coming radio power-atomic energy—all carry elements for the mutilation of humankind. In our highly civilized United States upward of nine million accidents occur every year—eighteen every minute. Three millions of these occur in the home.

The embalmers and the barbers were the first to devise systematic methods for dressing wounds. There were no surgeons, and the doctors, through long centuries, refused to "soil their hands" in the care of wounds. The apothecary, combining as he did the offices of doctor and pharmacist, treated all who came his way. To the pharmacist belongs the credit for devising new forms of bandages and dressings. These included healing mixtures and salves and plasters in varied forms and kinds. Long before the development of antiseptic surgery the pharmacist had made wound dressing applications which would prevent inflammation and the formation of pus and promote wound healing. This was long before wound-infecting germs had been discovered.

The modern, revolutionary era of surgery begins with Lister in the later decades of the last century. It has been tersely stated that at this time surgery moved forward "a thousand years in a day." With Listerism came gauze, cotton, bandages and dressings impregnated with antiseptics intended to destroy or prevent the growth of the germs of wound infection. Incidentally, Lister revived the use of the catgut ligature.

Lister's first systems were elaborate and cumbersome. Gradually the dressings were simplified and modified, and a system of aseptic dressings was projected in which the materials were sterilized by heat and other methods without the use of antiseptics.

In the inception of the antiseptic system, the dressings were prepared in hospitals. The lamented Dr. Charles Rice was an important factor in the preparation of hospital-made antiseptic dressings. The preparation of these dressings was so complicated that the small hospital and the ordinary practitioner were excluded from their use. Manufacturers, however, filled the need. They supplied dressings in

kinds and sizes suitable for physicians' office use. Thus the physician located even at a distance remote from hospital centres could adopt the antiseptic system of dressings. Under this stimulus "cheese cloth" or "mosquito netting" became "surgical gauze." Cotton fibre was made absorbent and rolled into sheets. These and similar appliances found their way into the drug store and became articles of trade. The old-time lint, tow, oakum and diachylon adhesive plaster were discarded.

First aid to the injured was born of the newer surgery. The layman found that an injury covered with a protective bandage healed without inflammation. Thus life and limb could be saved and suffering prevented.

The drug store has played an important part in the distribution of surgical dressings during the modern era. Without the druggist's aid progress would have been slow. The druggist, however, failed to follow the Continental mode of actually making these dressings a part of operative pharmacy. Only in the case of adhesive plaster and absorbent cotton have pharmacopœial standards been prescribed. The druggist has, in the main, been content simply to supply these items as his patrons might demand. He has done but little to increase their use and sale. This has been to the detriment of the drug store's prestige and profits.

FRED B. KILMER.

CATALOG OF ALCHEMICAL MANUSCRIPTS—A descriptive catalog of alchemical manuscripts in the United States and Canada has recently been undertaken by the Library of Congress in coöperation with the American Council of Learned Societies. It is the intention to describe with considerable fullness all pertinent items in Latin or Greek and also (if they do not prove embarrassingly numerous) in the vernacular languages of Europe. The Census of Medieval and Renaissance Manuscripts in the United States and Canada, prepared under the same auspices and now in the press, lists some 25 manuscripts on the subject, but these are all prior to the year 1600. For the present purpose there is no time limit; handwritten treatises on alchemy of even the present century, if such exist, may be included. Anyone who can give information regarding the location of alchemical manuscripts in this country is urged to communicate with W. J. Wilson, Director of Project E, Manuscript Division, Library of Congress, Washington, D. C.

ORIGINAL ARTICLES

THE AIR WE BREATHE*

By Louis Gershenfeld, Ph. M., B. Sc., P. D.
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BY THE use of complicated laboratory equipment and carefully mixing a variety of gases together in the proper proportions, atmospheric air can be produced. But this would be much more expensive than to breathe the air which Nature has provided ready-mixed in just the right proportions, and obtainable in adequate quantities everywhere. Pure dry atmospheric air is a mechanical mixture of various gases which possess the properties of weight, expansion and diffusibility and the resultant product is free of odor and devoid of taste or color. The two important gases are nitrogen and oxygen which occur on the average in the following proportion (per cent. by volume): Nitrogen 78.10 per cent. and oxygen 20.94 per cent. (or roughly in the proportion of 4 to 1). As far as is known nitrogen acts as a diluent for the most important constituent oxygen. The latter is necessary for life and for every kind of combustion. An atmosphere containing an oxygen content lower than 12 per cent. is dangerous. A candle will go out when the oxygen content is 16 per cent. or lower and in submarines when the latter content is reached, oxygen is replenished from tanks. Human life which generally shows the first symptoms of distress when the oxygen content falls below 15 per cent. cannot subsist if this oxygen content reaches 7 per cent. or becomes lower. Experimentation with other neutral or inert gases instead of nitrogen has revealed that this gas plays an important part in the phenomena of respiration by virtue of its degree of diffusibility. It is also interesting to note that the normal individual does not increase his consumption

Louis Gershenfeld, Ph. M., B. Sc., P. D.

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of oxygen when the nitrogen content is increased and is in excess in an environment. Mention should also be made of the fact that atmospheric nitrogen can be and is changed by the bacteria present in certain plants with the production of compounds of value to the latter.

THE COMPLEXITY OF AIR

However in addition to these gases the following are also present: Carbon dioxide (3 parts per 10,000 parts of atmospheric air [0.03%]); 0.94 per cent. argon and minute traces of helium, krypton, neon, xenon, hydrogen, hydrogen peroxide, ozone, ammonia, nitric and nitrous acids.

Carbon dioxide is produced by the burning of vegetable and mineral matter and by the normal breathing processes of men and animals. Its presence in amounts as to regard this gas as an impurity will be considered later. Ozone is a gas, a modification or form of oxygen, easily detected by its pungent odor (especially if present in amounts of one volume or more in two and a half million volumes of air). About thirty miles above the surface of the earth the atmosphere is said to contain a layer of ozone, the exact thickness of which is not known. The latter possesses the property of absorbing the ultraviolet rays of light, so that if it were not for the presence of the above-mentioned layer, all forms of life would be affected by the intense rays of sunlight. In our own atmosphere, ozone is present in negligible quantities. Traces are however produced whenever electrical discharges occur in the atmosphere and ozone may be more noticeable in the air of the open country and over the sea. The exact function of the so-called rare gases as argon, helium, krypton, neon and xenon is not definitely known but it is interesting to note the recent experiments by Professor Hershey of Kansas in which he reveals that animals eventually die when living in air from which carbon dioxide, argon, helium and the other rare gases are removed.

Many of the gases other than oxygen and nitrogen as well as impurities (in impure air) are the result of emanations from decaying matter, contaminations from manufacturing processes, smoke, soot and other substances, products of mineral and vegetable attrition. Atmospheric air always contains water vapor and the amount present varies. Animal and plant life could not subsist for any prolonged period of time without moisture in the air, but on the other hand as will be detailed later, excessive quantities are also objectionable. Varying amounts of finely divided solid matter in the form of dust particles containing bacteria and organic impurities may be present,

the quantities or degree of contamination by the latter depending upon different environmental factors.

Physical Factors

With the exception of the air in environments where due to certain industrial pursuits specific poisonous agents or detrimental hazards may be found, the chemical composition of the component parts of the atmospheric air is not regarded as the important feature in its deleterious effects upon our health. On the other hand physical agents such as the temperature prevailing, the humidity (or amount of water vapor) present and the existing air-motion or movement and similar factors which interfere with the body ridding itself of heat are assuming an increasing important role as more and more scientific evidence is being presented revealing the more exacting factors which interfere with and affect our comfort, efficiency and health.

INSPIRATION AND EXPIRATION

The lungs serve as the medium to facilitate the introduction of the air into the blood and the exhalation of undesirable gases. The former which is the act of inspiration is effected by the descent of the diaphragm and the elevation of the ribs. The act of expiration is effected by the elevation of the diaphragm and the descent of the ribs. Mention was made of the approximate composition of the air, which is that taken in (inspired air) by the lungs. In passing through the latter, the air loses a certain proportion of oxygen and otherwise undergoes certain changes. The expired air contains the same amount or a slight gain of nitrogen, or occasionally a slight loss of the latter as compared with pure atmospheric air may be noted. There is a slight gain in ammonia and an increase in the content or organic matter and water vapor. The carbon dioxide increases (to as high as 3, 4 and occasionally even 5 per cent.) at the expense of the oxygen in the expired air which decreases (to about 16 per cent.). This does not however mean that the changes in oxygen and carbon dioxide in the atmosphere in the immediate surroundings are affected as markedly. The truth of the matter is that even with the worst ventilation the changes in carbon dioxide and oxygen in such atmosphere in the immediate surroundings are comparatively slight due to a dilution with atmospheric air. The oxygen may fall to 21 per cent. or in rare instances to 20 per cent. and the carbon dioxide may rise to a concentration

rarely over ¼ to ½ per cent. Lower forms of plant life are capable of splitting up carbon dioxide in the presence of moisture and sunlight, the resulting oxygen being liberated to mingle with the other gases in the atmosphere and the carbon is utilized to build up the plant's own food supply.

THE AIR IN THE LUNGS

The volume of air inspired and expired by the adult (of average size and normal health) during normal breathing is approximately 500 cc. (a pint) (or 30.5 cu. in.). This is known as the tidal air. The total volume of air in the normal lungs is about 3500 cc. so that in normal breathing 3000 cc. (known as the stationary air) remains at the end of expiration. By forced expiration, half of the stationary air or 1500 cc. can be expired. This portion is known as the supplemental or reserve air. The remaining 1500 cc., known as the residual air, cannot be expelled. If inspiration is forced, an additional 1500 cc. of air, known as complemental air can be inspired, so that under forced conditions 5000 cc. of air can be found in the adult lungs. The total amount of air which can be inspired after forced expiration is known as the "respiratory or vital capacity" and serves as an index of endurance and reserve power and vigor.

THE POISON AIR BOGEY

As soon as it was found that in expired air there is an increase of carbon dioxide at the expense of the oxygen, the former was seized upon as the culprit which was harmful and the cause of so much trouble to man. The sentiment for many years was widespread that carbon dioxide was the cause of many ill effects due to overdosing with this chemical when rebreathing vitiated air containing it in large and excessive quantities. The carbon dioxide content of air in any environment was until recently employed universally in ventilation studies as the most convenient index of the degree of purity or impurity of the air. The belief in the harmfulness of this gas itself as it occurs in the ordinary occupied room still persists in some quarters in spite of the abundant evidence which proved that the injuriousness of this chemical in itself was unfounded. The maximum carbonic acid content in badly ventilated environments rarely reaches ½ per cent. while a content of almost 3 per cent. is regarded as the real danger point.

When carbon dioxide lost its adherents as the morbific agent exciting ill effects in poorly ventilated environments, "organic effluvia"

was presented in the so-called organic poison theory of bad air as the toxic agent. Then we find that the presence in expired air of a mysterious volatile organic poison was blamed for the annoyance and discomfort in crowded rooms. "Sewer gas" and emanations from swamps have been at one time or another credited with producing various ills. The remedy in treatment so as to maintain good health and secure comfort consisted in the main in diluting the air in any environment by flushing the atmosphere with outside air so as to keep down the concentration of these apparent evil causative agents of ill health.

Ventilation

A consideration of any of the foregoing factors (as is evident) is necessarily interwoven with facts concerning the replacement of vitiated air with pure air, which is the problem of ventilation. Perhaps one might add that ventilation is the proper regulation of the indoor air in any environment so as to obtain the maximum of health, comfort and efficiency. While it is true that many individuals living in this modern scientific age do not regard poisonous exhaled vapors as the cause of discomfort in poorly ventilated environments, it is nevertheless a fact that there are entirely too many living today who do not realize the underlying factors which account for the same feeling of oppression, discomfort and stuffiness experienced by those many years back who held the former erroneous beliefs.

WHY VENTILATE? The blood a circulating nutritive fluid is constantly interchanging its gases with the air in the lungs which as a membrane allowing the passage of gases serves as a temporary dumping and loading or refilling station. Though air may be introduced into the latter with perfect regularity, unless the blood is capable of doing its share in rendering the change, respiration will cease. In other words the tide of air in the lungs does not in itself strictly constitute respiration. To repeat again the lungs serve merely to facilitate the introduction of oxygen into the blood and the exhalation of carbon dioxide. The undesirable products of respiration contained in the blood pass out and vitiate the air. The humidity of the air is increased by the moisture given off from our breath and skin. The temperature in the environment is raised by the heat given off in the process of metabolism. Varying quantities of organic matter not only from our mouths but from our hands,

skin, hair, and clothing are also aiding in changing the composition of the atmosphere in a confined space. Thus heat, moisture, carbon dioxide, a small quantity of ammonia and some organic matter are added to the air in our immediate surroundings.

The average dwelling is not airtight. An interchange of air between the inside and outside is going on constantly through walls, cracks around doors and windows and during the opening of the latter. In the ordinary home, where there is ample space and comparatively few people occupying the latter this natural interchange is generally satisfactory and usually sufficient to maintain the necessary comfort required by human beings. If such desirable conditions do not prevail or if the ratio of people occupying a given environment is increased, the natural interchange of air may not be effective in itself in diluting the atmosphere so as to maintain the desired standards. The body's ability to withstand a decrease in the oxygen content and an increase in the amount of carbon dioxide is greater than its ability to withstand changes in the physical characteristics of the atmosphere. It is also apparent that the natural diffusion of the chemical gases is much more rapid than the diffusion of water vapor, heat or organic emanations. One of the main purposes of proper ventilation is to keep the body in an environment so that the loss of heat from the body will take place at the proper rate, not too rapidly and not too slowly. The body must maintain the physiological integrity of its internal environment with the minimum amount of strain. Most individuals quickly learn that the presence of a plentiful supply of fresh air or living in the open air is beneficial to our health. This is not due necessarily to the fact that we breathe purer air in the open than we can get in our homes. It is primarily due to the fact that the almost constant motion (in the open) carries away the body heat. A heightened cell activity and subsequent beneficial stimulation of the skin will be the result.

Factors of Operation in Ventilation

It is impossible to give any set standards by which one may be able to determine the efficiency of ventilation or the purity of the air. The following are the important factors that must be borne in mind:

1. Temperature

It may be stated that the best results are obtained when the temperature does not rise materially above 68° F. or fall below 62° F.

It must be remembered that the power of diffusion possessed by air increases as its temperature rises. Consequently, there is always a tendency for the heated air of a room to escape and to be replaced by cooler air from the outside. Overheating has been definitely established as the primary cause of ill health in badly ventilated environments. It not only produces discomfort and decreases efficiency, but also predisposes to respiratory infections. It may be stated here that ventilation is intimately connected with other factors, such as temperature, humidity, air motion, physical condition of persons exposed, and with problems of personal hygiene, especially with the wearing of the proper clothing, bathing, etc. The amount and kind of clothing worn by individuals and methods and frequency of or prolonged bathing may produce an unhealthy tone of the blood-vessels in the skin.

2. Humidity

The moisture should not be above 50 per cent. relative humidity (the wet bulb under 70° F.). High temperatures combined with high humidity are very harmful. On the other hand, it must be borne in mind that the humidity should not be reduced below normal, as very dry air is an important predisposing cause to some diseases and general bodily discomfort. Individual comfort depends not only upon the temperature recorded by the dry-bulb thermometer, but equally as well and at times almost entirely on the wet-bulb temperature. The wet-bulb temperature is best obtained when using the sling psychrometer, which is the standard instrument for measuring humidity. More details concerning humidity will be considered later.

3. Air Motion

The movements of the air decrease the discomforts of high temperatures. Air motion is one of the simplest and most inexpensive of the available methods which can be employed to produce a cooling of any environment. By bringing more air in contact with the body, the movement of the air results in the carrying away of more heat. If the temperature is very high other means should be employed to reduce this before setting the air in motion, as the benefits derived from the latter alone at excessively high temperatures are small, if any at all. The air should be in gentle but not excessive motion and without draft. The purpose as you see is to facilitate evaporation and the elimination of heat. This will keep the body surface cool, and at the same time

exert a stimulating effect. On the other hand perceptible drafts and marked fluctuations in room temperature should be avoided as they cause chilling of the body and thus are very dangerous to that body. You will observe that even though the actual temperature does not change, the operating of an electric fan aids in cooling an overheated body uncomfortable in a warm room or a warm environment. The same electric fan or drafts in a cold room by keeping the air moving more rapidly will result in a greater chilling of the body.

4. Carbon Dioxide Content

The permissible limit for indoor air is placed at from six to eight parts per 10,000, preferably keeping to limits not in excess of six parts.

5. Other Pollutions

The air should be free from large amounts of dust, bacteria, poisonous and objectionable fumes, smoke and offensive body odors. There are enormous losses produced annually in this country in the injury to public health and to plant and animal life by gaseous and other pollutions.

Methods of Ventilation

Methods of ventilation today are planned with the foregoing factors in mind and not solely with a view of maintaining the carbon-dioxide content of an environment below a certain level. It must also be borne in mind that, though the proper indoor air space is available, this is not a definite assurance that ventilation is taking place. Satisfactory ventilation demands a generous supply of clean fresh air, introduced by some efficient means at the proper temperature and humidity, and maintained in a gentle movement.

The natural forces of ventilation, winds and diffusion, acting through cracks and crevices in walls, the intelligent opening of doors and windows, ventilate with a fair degree of efficiency private dwellings and industrial establishments where crowding is not great. The air is kept in almost constant motion through changes in temperature. It is, therefore, apparent that, due to greater differences in temperature, natural ventilation is better in cold than in warm weather. Too much moisture on the inside or rain on the outside may clog up pores of building materials, preventing the access of fresh air or the escape of carbon dioxide. Outside obstacles, as vineyards or other excessive foliage, signs and similar exterior decorations, narrow streets, etc., may also aid in hindering ventilation. Natural ventilation may be

greatly favored and improved by simple devices. Devices for warming the air (open fireplaces), for keeping out the dust and strong wind currents (screens made from cloth or similar material), and different types of window ventilators, which allow the entrance of fresh air or the exit of vitiated air, aid considerably.

It may be necessary to supply proper inlets for fresh air and outlets for vitiated air in larger buildings and dwellings, where natural ventilation is used. In most cases fresh-air inlets are placed near the floor, and the outlets for vitiated air are placed near the ceiling. They may be placed more advantageously upon the same side of an inner wall or on opposite sides, rather than upon the floor and ceiling proper. The size of the openings depends upon the velocity of the incoming air, and it is best to proportion the area (if large) over many openings rather than over one large tube. Air ducts should be protected with screening wire and cleaned periodically. The wire will keep out rats and vermin, dirt, etc.

Natural ventilation can be assisted by many devices. The Fairfield system of modified window ventilation is a simple system of modified window ventilation which permits the free ingress of air through the windows, and by means of slanting window boards on the sashes the air is deflected toward the ceiling, to be mixed with the general air of the room. Radiators are placed directly under the windows so that the air is heated directly; its velocity is reduced and direct drafts upon individuals in the room are kept at a minimum. A duct is also provided, so that the vitiated air from near the ceiling is allowed to pass to the outer air. The King system is another improvised method for aiding natural ventilation in use in stalls where cattle are kept.

Artificial Ventilation

It is obvious that natural forces, even with minor mechanical aids, cannot ventilate very large buildings. For these, mechanical apparatus is required, and ventilation so secured is called "artificial."

These "artificial" systems of ventilation may be divided into three groups: (1) Those which provide for the mechanical extraction of the air, called vacuum systems; (2) those which provide for the mechanical introduction of air into the room, known as plenum systems; (3) those which provide for both the introduction and extraction of air, *i. e.*, a combination of the plenum and vacuum systems.

The extraction of the vitiated air from a room as the sole system upon which to depend is only satisfactory in conjunction with a known pure and fresh air supply. If mechanical systems of ventilation are required a combination of the plenum and vacuum systems is the best method to employ. If but one method of artificial ventilation is to be used the plenum is by far superior to the vacuum system. Mechanical proportion of air is performed by fans or blowers which are run by gas, steam, electricity or other power. By this means the air is driven through ducts to environments where it is needed. It cannot be too strongly emphasized that each environment furnishes problems of its own, and that a thorough study may be necessary to determine the best mechanical aids required to supply fresh cool air in conjunction with natural means. No system can be depended upon to give universally satisfactory results at all times. Constant watching, supervision and modifications if necessary, are essential to a successful operation of any system, so as to obtain pleasant and wholesome air conditions. In our many large buildings, industrial establishments and apartments, battleships and vessels, with their basements and sub-basements, artificial ventilation is frequently the sole means of supplying air to those environments. In industrial plants, where observations and checks are possible, proper ventilation aided by artificial means have resulted in better health, an increased efficiency on the part of the workers and an increased output and greater financial return to the respective industries.

Heating

One of the main objects of ventilation is to avoid overheating, *i. e.*, keep the body cool, but not cold. It is, therefore, obvious that the study of ventilation and heating are intimately connected, and it is impractical to consider one without the other. One of the first lessons in ventilation that one learns is that the heating system shall not be the cause of an excessive temperature or the drying of the atmosphere in an environment. Three kinds of heat are made use of in warming buildings: Radiant or direct heat, convected or indirect heat, or a combination of direct and indirect heating.

The open fires heat through direct radiation, although such direct heat is considered more healthful, because open fireplaces are good ventilators, but they possess the disadvantage of utilizing but a small portion of the fuel value. They can only be depended upon as the

chief source of heat in small rooms. In combination with other systems of heating they are very efficient as ventilating agents, changing the air in the ordinary room in one to two hours. Open heaters burning gas or oil are objectionable. They may not only cause excessive dryness of an atmosphere, but they may impart various odors, due to leakage or from products of combustion. Heating by electricity does not have the objectionable feature of contaminating to any great extent the atmosphere in an environment, but it may cause excessive dryness, act as an inferior ventilating aid and is also too expensive for ordinary use. Although stoves utilize more of the fuel than open grates or fireplaces, they generally heat rooms unequally. The stove pipes may carry off most products of combustion, and there may be better circulation of the air, only if the proper care and attention is given to the fire, damper, etc.

HOT AIR

Hot-air furnaces supply a large amount of convected heat and fresh air. They cannot satisfactorily warm rooms situated at a too great distance from the furnace, and accordingly are not adapted to heating large buildings or groups of buildings. The objection of the hot-air furnace is that the air may become excessively dry and even partly burned. Such dry air is offensive, and living in such an atmosphere is not normal, and harmful to many. Under such conditions the body loses an excessive amount of moisture both through the skin and mucous membranes, so that the liability of catching colds is increased. To overcome this, moisture should be supplied in such rooms, which may be furnished by one of several methods. The water pans provided in some of the hot-air furnaces cannot possibly furnish sufficient moisture, and it is, therefore, necessary to see that the proper humidity prevails.

Hot water and steam will carry many times as much heat as an equal weight of air at the same temperature. Such systems of heating are very simple and they are the most effective methods of heating buildings. Hot water is more readily controllable than steam, and affords the most economical method of heating dwellings and small buildings. High-pressure hot-water heating and, still better, steam heating are especially adapted to the warming of large buildings or the distribution of heat from a central point is found convenient. It is important to emphasize that there should be present the proper amount of radiation surface to heat any environment. The amount of radiation depends primarily upon the temperature desired, the

amount of wall and air space, the exposure of the room, the number of doors, windows, inlets and outlets, the average outside temperature during cold weather, etc. Even in this system the air may become abnormally dry, though not to the same degree as when using hot-air furnaces. It is, however, important to overcome the dryness of the air. This is easily accomplished in the hot-water and steam systems by attaching water pans to the radiators. Water placed here will be allowed to evaporate slowly, and the proper humidity will thus be obtained.

The Cooling of Environments

We have become accustomed to heating environments in cold weather due to necessity. Little attention has been given, however, until recently to the cooling of rooms in the hot seasons or in warm climates. More attention is being given to these operations than heretofore, as not only are such procedures practical, but may even become a necessity to health. There are many buildings and hospitals in this country that provide cool rooms and compartments. Very simple devices may be used as the method for the cooling of the room. Humidifiers, air washers of different designs and the freezing machines on a large scale are employed. In the more modern methods of air conditioning, equipment is being installed to make our vehicles of transportation, theatres, mercantile establishments and other buildings and even our homes more comfortable during the warm seasons of the year.

Pressure

The pressure of the atmosphere at sea level is 15 pounds to the square inch so that a man of average size living at sea level is exposed to a total pressure of approximately 34,000 pounds or more than 15 tons. The tissues and fluids of the body subjected to this pressure are however in equilibrium with it. Slight variations in pressure as may occur from day to day at sea level reveal but little physiological effects upon animal life. On the other hand a sudden change and diminution of this normal pressure as may be encountered at high altitudes and in aviation will result in various bodily disorders. The symptoms and discomfort produced by a marked diminution in atmospheric pressure vary, but in the main they are due to the low partial tension of the oxygen and are equivalent to the breathing of rarefied or diluted air. The dangers of the latter are those of oxygen

deficiency and such threatening symptoms are relieved by adding oxygen to the air inspired. Though sudden changes from sea level to a rapidly reduced pressure may result in marked physiological changes unless oxygen is added, it is possible for man to gradually become acclimated to a reduced pressure and the breathing of rarefied air at great heights as in mountainous areas, etc. The normal pressure at sea level will maintain (as indicated in the barometer) a column of mercury 760 millimeters (or 30 inches) while the limit at which human life may be sustained is about 26,000 feet at which height the barometric pressure of the atmosphere is 251 millimeters.

Man may often find himself naturally exposed to rarefied air and a reduced atmospheric pressure but he is only subjected to a marked increased atmospheric pressure under artificial conditions as in diving suits, diving bells and caissons (the pressure being usually four atmospheres or approximately sixty pounds per square inch). The increased atmospheric pressure as found in some deep mines has but little effect on the well being of normal adults. The abnormal physiological effects of an increased atmospheric pressure and a too rapid decompression are occasionally observed in divers and workers in caissons and the so-called "caisson disease" reveals symptoms due in the main to an increase in the excessive amounts of the gases of the atmosphere which are taken up by the blood.

Humidification

The amount of water vapor in the air at a given time is generally expressed in relation to the total amount which it could hold at the existing temperature and pressure. When the RELATIVE HUMIDITY of the air is said to be 50 per cent. we mean that the air in that environment (under the existing temperature and pressure) contains just 50 per cent. of the amount of water vapor which would saturate it (before the excess of moisture over the saturation point will condense in the form of dew). For instance at 68° F., 100 per cent. relative humidity actually means the retention of approximately 7.5 grains of water vapor per cubic foot of air, for this amount will actually saturate the air at that temperature. At 0° F., when air is saturated with moisture (100 per cent. relative humidity) a cubic foot of air contains 0.56 grains of water; at 30° F. there are 1.94 grains of water (when the relative humidity is 100 per cent.) or three and a half times as much as at 0° F. but only one-fourth as much as at

68° F.; and at 85° F. approximately 13 grains of water are present in each cubic foot of air (100 per cent. relative humidity) or twenty-three times as much as at 0° F., six and eight-tenths times as much as at 30° F. and one and seven-tenths times as much as at 68° F.

A proper degree of relative humidity of from 40 per cent. to 50 per cent. at all times even in artificially heated buildings in winter is necessary as a health measure. In the so-called comfort zone in temperate climates there should be a maximum temperature of 70° F. and a minimum relative humidity of 30 per cent., and a minimum temperature of 60° F. with a maximum humidity of 55 per cent. If the humidity drops below 20 per cent., the environment is generally uncomfortable. When cold outdoor air is heated to 60 or 70° F., it becomes mad for moisture, abstracting it from every available source. A relative humidity of 70 per cent. in an environment which is cold would be quickly changed to as low or even lower than a 20 per cent. relative humidity when this environment is heated. The heating of air reduces the relative humidity. It is therefore apparent that cold air even with a normal or high relative humidity when heated will result in the production of warm air with a low relative humidity which tends to extract moisture from the immediate surroundings. It is to correct this condition that humidification is practised today. It must also be remembered that when the humidity is low excessively high temperatures are necessary for warmth. The harmful effect of the excessively dry indoor air in artificially heated buildings are observed especially in their effects on the mucous membranes of the nose and throat (respiratory infections) and upon the skin. On the other hand excessive moisture in the atmosphere (a high relative humidity for the particular temperature conditions) makes hot air feel hotter and cold air feel colder. A high atmospheric humidity with a high temperature is detrimental to health. Damp air has a very different cooling power than dry air. Extreme cold is better borne by the human organism than extreme heat partly due to the fact that clothing and other artificial controls are available and employed.

"NOSE SHUTTERS"

It may be of interest to note that Sir Leonard Hill, prominent English scientist, reported recently that the so-called "infra-red" rays given off by dark or dull-red sources of heat cause the nostrils to contract (due to a reflex effect from the sensory nerves of the skin) and there results an inter-

ference with breathing. If this will be found to be the case, there will thus be presented a reason for the stuffiness experienced in overheated rooms. It is said that these objectionable rays which he calls "nose-shutters" are absorbed by water vapor and this may be the explanation of the efficacy of a pan of water placed near the source of heat.

Humidifiers

There has been added to the present day ventilating equipment the humidifying pans, steam jets and on a larger scale the air-washers which add not only moisture to the air but also remove dust. Automatic humidity control is practiced on a large scale but in the average home or dwelling this may not be possible. But here just as it is essential to have a uniform temperature in each room, a uniform moisture content is just as important. Occupants in airy environments properly humidified will be comfortable at comparatively lower temperatures than in environments where there is an insufficient amount of water vapor and where a higher temperature may be required to obtain comfort. It is therefore apparent that there will be a saving of fuel in the properly humidified house. There will always be a lower incidence of respiratory disease. Improper humidity due to excessive drying is also harmful to furnishings, books, etc.

Artificial methods of humidification must take into consideration the fact that the moisture content in the atmosphere is a variable factor. Any system to prove most valuable should automatically evaporate water in proportion to the heat which is radiated taking into consideration at the same time the moisture already present in the air. The humidifier should be a simple and inexpensive contrivance. Best results are obtained in the home by installing a humidifier on each heating unit (radiators if present) if it is desired to maintain a satisfactory and even distributed degree of humidity. It is even possible to install a simple device which will not only supply the necessary moisture but at the same time remove objectionable odors, smoke, dust, animal emanations, and lint and fibers from the air in artificially heated houses.

Poison Gases

There are specific poison gases to be found in the atmosphere in workshops which are industrial hazards and of concern to certain and particular industries. But there exists a menace to everyone in the danger of poisoning by gases which are produced during the improper

heating of certain basic fuels or due to leakage in other instances. Carbon monoxide, sulphurous acid and sulphuretted hydrogen are the main offenders. Of these, the first named heads the list as the troublesome constituent in vapors from exhaust systems from gasoline driven vehicles, coal fumes (when coal or charcoal are burned improperly) and from illuminating gas.

PETROMORTIS Monoxide poisoning is one of the most insidious of the dangers confronting a faulty coal heating system or the automobile user where the exhaust systems of the vehicle have developed leaks. The gas produced by fuel combustion is invisible, odorless and tasteless. Frequently the first recognition of the menace is a helpless drowsiness which passes quickly into unconsciousness. The oxygen in the air is conveyed to the various tissues by means of the hemoglobin (the protein iron pigment in the blood). The latter in normal health forms oxyhemoglobin which is easily dissociated, the oxygen being taken up by the tissues and the hemoglobin (now spoken of as reduced hemoglobin), passes through the venous system (taking along various gaseous impurities), finally reaching the lungs where more oxygen is taken up. Carbon monoxide is capable of combining with hemoglobin producing carbon monoxide-hemoglobin, a compound not as readily dissociated as oxyhemoglobin. The result is that in poisoning by this gas, the resistant compound takes the place of the respiratory oxyhemoglobin. Death results from what is practically suffocation and due to a lack of oxygen in the circulation and not necessarily to a lack of oxygen in the environment or in the atmosphere. It is not the free oxygen in the air which may be lacking, but it is the conveyor of the latter (the hemoglobin) which is bound and thus the oxygen in the air cannot be carried to the tissues. The affinity of hemoglobin for carbon monoxide is more than 200 times as great as its affinity for oxygen and accordingly in the presence of comparatively small amounts of carbon monoxide in the air an appreciable quantity is taken up by the blood.

Bacteria in the Air

The numbers and types of bacteria in the air bear a close relation to the atmospheric conditions and other environmental factors. Dryness and high winds result in more suspended dust particles with a corresponding increase in the bacterial content. Humidity and a lack of wind currents decrease the latter. Bacteria do not rise and float

about from a moist surface. Even from dry surfaces bacteria will rise only when the air is agitated by the natural wind currents or air-currents produced artificially. Environmental factors play an important rôle. Bacteria are present in smaller numbers in the country, in mountain air; and in mid ocean, the air is almost free of micro-organisms. Even in cities, they are more plentiful in densely populated areas and within buildings where large numbers of people congregate.

The kinds of micro-organisms present in the air vary, depending upon the locality, but in most environments certain species are commonly found. Molds and yeasts are more frequently found and are apt to outnumber the bacteria. It is the presence of the latter which when getting into the expressed saccharine juices of fruits cause alcoholic fermentation. It is the former which cause the spoilage of foodstuffs. Of the lower forms of bacteria, the ones producing spores which are more resistant to sunlight and drying are more apt to be found and are of almost universal distribution.

The commonly observed disease-producing bacteria are of rather rare occurrence in the air except probably in the immediate environment of those who are sick and careless about their personal hygiene. Unfortunately for many years the air has been considered as the chief vehicle of infection and many diseases were regarded as air-borne. The sewer-gas bogie and the effluvia from decomposing animal matter as the alleged cause of various diseases were facts held for years by many workers. Today we know that the rôle of infection by air is of less importance than was formerly believed. Even in congested environments, infection is probably spread solely by close contact rather than by the air. I bring to your attention the present practice of aseptic surgery as illustrating the changes which have taken place in our conception of the part played by the air as a bearer of infection. In Lister's original aseptic surgery technique, the air in the atmosphere regarded as the chief source of infection was disinfected with a carbolic acid spray. The spray was started hours before the operation and it was continued until the latter was finished. Today, this procedure is never practiced and infections from the air are not known. Though air infection in surgery and wounds is not impossible, it is however highly improbable and infection here is to be considered from the standpoint of direct contact with infected material, visible droplets coming from a mouth spray, etc. One must also remember that the possibility of infection depends upon the disease-inciting power of the

particular species of micro-organism and upon the numbers (dosage) of the latter.

The exact relation and important rôle of the air as a means of conveying disease is known in many instances. Modern scientific methods have definitely established the fact that typhoid fever, dysentery, diarrheal conditions, typhus fever, and similar diseases are not air-borne. The importance of air conveyance in pneumonia, influenza, diphtheria, meningitis, and most other respiratory infections though not as clear as it might be is however such as to furnish the belief that there is no basis for regarding these diseases as being contracted in appreciable numbers through inhaling air. Even measles, scarlet-fever, whooping cough, poliomyelitis, chicken pox, and smallpox, the latter widely acclaimed as an infection of the atmosphere, are not regarded as air-borne.

AIR-BORNE DISEASES

Great fear is at times manifested by certain people when it is proposed that a hospital for contagious diseases should be located in their neighborhood. The question of the aerial transmission of these diseases is brought immediately to the forefront. A rather extensive array of evidence is available to prove that most diseases affecting patients housed in such hospitals are not air-borne. The causative agents of many commonly observed diseases are of feeble resistance and drying is sufficient to modify or destroy their disease-inciting power. They are therefore unlikely to be air-borne and certainly cannot be dust-borne. In hospitals as elsewhere, the great factor in the spread of infection is by contact. Convincing evidence against aerial transmission of many diseases (so regarded previously) is the fact that it has been found convenient to care for different contagious and infectious diseases in rooms only partially partitioned or even in one open ward. As long as the modern developed medical aseptic methods are practiced, contact of different patients are prevented; and if attendants observe the proper sanitary measures in guarding against the spread of disease by a technique similar to that employed by surgeons in preventing the infection of areas during operation, then there is no spread of different diseases from one patient to another. Aerial transmission here proves itself of no importance in the spread of disease. It is only when the patient or the attendant (in passing from patient to patient) does not take special care that there results a spread of different diseases or cross-infections. It is "contact" and not "aerial

transmission" which is the factor. Bacterial conveyance by air in the case of tuberculosis needs further elucidation. Inhalation of anthrax spores producing the pulmonary form of the disease, the so-called wool sorter's disease is possible and presents the most convincing evidence of the air serving as a vehicle for carrying a causative agent of disease. Persons handling contaminated raw wool, hides, horse hair, etc., where numerous spores of anthrax which resist drying even for years have in turn filled the air in their working quarters are known to have developed the pulmonary form of anthrax which manifests itself as a violent, irregular highly fatal pneumonia. When no precaution was taken (as in days gone by) to prevent the breathing of dust infected with spores of anthrax, the latter disease was much more prevalent than it is now.

In brief it can be said that under ordinary conditions of home, modern working plant, hospital, etc., there is little evidence to prove that aerial transmission is a factor of any importance in the spread of the diseases commonly observed in this country. There is little to support the contention that dust is a dangerous vehicle harboring disease producing bacteria. Anthrax which is a disease that can be spread by air laden with anthrax spores is of concern only in specialized industries and here hygienic methods, proper ventilation and other sanitary precautions have reduced the occurrence of this infection. The only consideration of moment is the possible spread of tuberculosis by air laden with tubercle bacilli, but this needs further observation and experimentation.

I have conducted a large number of routine bacterial examinations of air in dwellings in industrial plants and in other environments but the findings obtained did not prove of much practical significance. The presence of dust particles (to which bacteria adhere) yields results of greater value as to the sanitary condition of the air in any environment and these can be determined by simpler techniques.

Dust

Dust in the ordinary atmosphere is not as big a factor in the spread of disease as the layman seems to believe. The harmful effects of dust in the air of the home, etc., if any, are not due so much to the disease-producing organisms which may be present as to the irritation apt to be produced on the mucous membranes of the nose, throat, eyes,

etc., so that organisms already present here may have a better opportunity to exert their effects.

The composition of the air in the surroundings where workers are required to labor may have a great bearing not only upon their health but upon their duration of life. Everyone is familiar and aware of the harmful and ill-effects to our health of surroundings that are dark and damp, or where excessive heat or cold and dryness may be present. But of all working conditions, those where workers are forced to carry on their occupation in an environment in which the air is laden with mineral and metallic dusts are the most dangerous. Yes, they are not only the most dangerous but the most insidious of destructive agents, far exceeding industrial accidents in final total fatalities.

We say we are civilized. We speak about humane legislation. Yet individuals in this great country of ours are allowed to work in environments which due to dust or poisonous fume hazards (especially the former) are killing hundreds and hundreds of workers annually. No attempt is made to examine periodically such employed persons to determine their physical fitness. Safety devices may be furnished but approved apparatus to remove dust and satisfactory masks may not always be present. In some instances the prescribed regulations are not properly enforced as the workers are not given to understand and therefore do not appreciate the seriousness of the dust hazards until it is too late. It is difficult to understand why an individual in this country can collect workmen's compensation if he injures a bone and develops tuberculosis, but if the latter disease affects his lungs or he contracts silicosis in which his employment is a contributing factor his compensation is not covered by such an injury (except in six states—California, Connecticut, Maryland, Massachusetts, North Dakota and Wisconsin. Hawaii can also be included). In this country, Federal laws directly applicable to the enforcement of preventive measures and compensation if the liability was due to the fault of the employer have not been enacted as in Australia, New Zealand, Great Britain, South African Union, Germany and even in one of the Canadian provinces.

The various forms of disease caused by the inhalation of dust are known collectively under the term pneumoconiosis from the Greek word pneumon, lung and konis, dust. When the dust inhaled is coal, the specific term anthracosis is used; if dust from stone cutting causes the affection, chalicosis (Potter's disease) is the term which is at times

employed to describe the condition; to the affection in which metal dust is inhaled, the term siderosis is applied; to the affection caused by the dust of asbestos, the condition is spoken of as asbestosis; and to the inhalation and accumulation of minute particles of pure silica dust in the lung, the silicosis is applied. The composition of the dust inhaled governs the kind and seriousness of the lung affection, but the underlying feature in the abnormality so produced in all instances is a replacement of the spongy elastic tissue of the lungs by an unyielding tough fibro-connective tissue so that the lungs cannot expand and contract as they normally should. The lungs under such conditions may be invaded by numerous organisms among which the bacillus causing tuberculosis is the most frequent offender. In other instances, pleurisy, bronchitis, influenza, pneumonia and similar affections may occur. In other instances the silicosis may not be infective (*i. e.,* bacteria, an added damaging element, may not have invaded the affected area) and death may result without the lungs ever having been subjected to the ravages of the tubercle bacillus or other organisms, though it is a known fact that the incidence of tuberculosis and other respiratory diseases is greater in those exposed to a dust hazard.

It is now generally accepted that free silica (SiO_2) in a finely divided state or possibly as derived from certain silicates is the most harmful agent in most dusts which affect the lungs to any serious degree. The important factors in the amount of damage caused depend upon (1) the mineral composition (silica content) of the dust; (2) the size of the individual (silica) particles; (3) the number of these microscopic particles per cubic foot of air; and (4) the length of exposure of the individual to this dust containing free silica, for upon this depends the amount inhaled or dosage received. The higher the silica content of the dust the less exposure is needed to produce a silicosis providing the particle content is high and most of these particles are 1/2500 of an inch or less in size. I have the records of several scores of cases of silicosis in which many deaths have resulted, the individuals having been employed in a very dusty environment in some instances less than six months and in most all cases less than two years. They were getting at all times an overwhelming dose of dust containing 98 per cent. pure silica all of which was in very fine particles. The silica contents of the ash of the lungs in over a dozen of these cases which I analyzed varied from 30 to 40 per cent. as com-

pared to an approximately 8 per cent. silica content in the ash of a lung of a female and a 13 per cent. silica content in the ash of a lung of a male, both having had a natural death.

Dust in the air in working establishments is a more or less natural condition for which a certain degree of allowance must be made in our modern industrial development. Accordingly pneumoconiosis and most frequently silicosis and resultant infective respiratory diseases are the apparent risk as part of commercial pursuit. But the serious aspects of these affections and their progress can and should be reduced to a minimum even though their incidence in some industries cannot apparently be eliminated entirely. The particular hazards in the individual industries must be carefully studied and realized. The result should be the introduction of satisfactory legalized regulations for health protection and the adoption of suitable compensation laws for such industrial diseases.

SILICOSIS

It is of course impossible to discuss here the great variety of actual uses of silica in industry, the presence of silica in dangerous quantities in the various dusts present in so many industrial pursuits and in turn the opportunity afforded for its inhalation in dangerous quantities by workers. The use of the mechanical and pneumatic drill invariably presents an added hazard. Drilling produces a fine dust which is allowed to escape (unless the drilling is done under moist or safeguarded conditions). The finer the dust the longer will it remain suspended in the air. Hard rock mining, especially if the rock is of a siliceous composition (as is most frequently the case) presents an industry which includes the largest number of workers engaged in a single hazardous occupation. The drilling may be in a gold mine, in granite cutting, in sandstone quarrying, in coal, metalliferous ore, asbestos and other mines or even in blasting or rock drilling in subway and tunnel construction. Dusts produced in the cement industry, in the abrasive industry, in sandblasting, in the pulverizing of sand (the latter being employed as an ingredient in scouring powders, tooth powders, in vitreous enamels, in glass manufacture, etc.), in potteries and in commercial and manufacturing industries in which asbestos, sand or other finely divided siliceous material is the ingredient present in a large percentage are frequently the factors in industrial disease.

The important preventive measures against these industrial diseases which benefit employees and employers alike may vary depending

upon the particular hazard. Wherever possible dry drilling should be avoided. Wetting in the form of a fine spray or damp processes may be of value in certain other cases. Cleanliness is a necessary factor at all times. Proper and satisfactory means of ventilation and approved mechanical extraction of the dust should be made available. The use of efficient filters or masks for workers may be essential for some in certain industries. Enclosing the machines producing the dust should be practiced wherever possible. The employees should be advised and warned of the dangers facing them so that they may appreciate the value of co-operating to the fullest extent. It is unfortunate but an actual fact that the worker who is being protected is usually the hardest factor with which to deal. It is much easier to get employees to protect themselves against injury by machinery but they may be very careless with dust which may mean death within a few years. Periodic medical examinations and measures directed toward the non-employment of tuberculous individuals or suspects and the immediate elimination of diseased workers should be carried out.

Smoke

Smoke a mixture of gases containing solid particles is a product of combustion. Smoke in the atmosphere, especially if present constantly or in excessive amounts, exerts a deleterious effect upon our health. There is a close relationship between the smoke constantly present in an environment and the susceptibility to and incidence and increase of respiratory diseases. This is due to the fact that smoke will irritate the mucous membranes of the nose, throat, eyes, etc. Smoke is a source of dirt and is a general nuisance in that it soils everything and deters the opening of windows to let in fresh air. Another evil resulting from the presence of smoke in the atmosphere and especially when combined with mist to produce fog is the loss of light rays (or daylight) and the fact that the ultra-violet rays from the sun are cut out to a great extent. The preservation of our health and good eyesight, the improvement of comfort and general efficiency and the prevention of accidents are largely dependent upon the presence of good light and especially upon the sunlight in our environment so that when the amount of the latter is lowered due to the presence of smoke in the atmosphere, there will result an increase in ill-health and in making maximum efficiency impossible.

It is a known fact that we have many valuable laws on our statute books which for one or several reasons are never properly en-

forced. There are at least 125 cities in the United States and Canada which have anti-air-pollution laws, but such ordinances alone do not purify air in any environment. Electrification of steam rail lines is aiding considerably in improving atmospheric conditions in many communities on account of the reduction of smoke and dirt in the air. But on the other hand due to prevailing economic conditions, there has come into use a cheaper and dirtier fuel resulting in an increase of carbon and other particles in the atmosphere. No serious attempts are made to reduce this industrial smoke, 80 per cent. of which could be removed by the use of mechanical devices. Accordingly a city like our own must harbor over 200 tons of dust and dirt particles in the atmosphere (most of which come from coal and fuel) due to the fact that the anti-air-pollution laws are not enforced. The menace of this to our buildings, property and health should be appreciated sufficiently as to warrant some action against such evil. A complete smokeless environment especially in larger communities would be practically impossible to attain but smoke and dust hazards can be reduced to a minimum. Even the evil of dirty motor vehicle exhausts could be eliminated to a great extent resulting in worthwhile accomplishments in progress for the improvement of atmospheric air.

Allergic Diseases

Allergy (altered energy) is a condition wherein an animal displays an unusual or an exaggerated susceptibility to a substance which is harmless in similar amounts for the majority of members of the same species. There is a marked variation in susceptibility of different animals and humans to allergic reactions resulting in a variety of symptoms and abnormal conditions and changes. There is an exceedingly large number of substances which may act as the exciting agent causing an allergic condition. Various foods, bacterial proteins, drugs and chemicals, etc., may be found as the essential factors. But here, speaking of air, I desire to direct your attention to the inhalation of air containing ordinary house dust, dust from orris root and other drugs, and air containing dust from hair, feathers and effluvia of many lower animals and the many pollens from flowers, grasses, trees, weeds or other plants. It is the inhalation of the air containing these substances which may be the cause of most of the different forms of asthma and of hay fever. There are at least over one million cases of the latter diseases annually in this country alone.

SENSITIZATION It is at times difficult to determine the exact cause of these allergic conditions. But if one is successful in finding out the substance or substances to which the individual is sensitive the simple procedure of avoiding the latter if that is possible will result in clearing up all symptoms. For instance, house dust sensitization may be relieved by avoiding stirring the dust in the house, especially in the sleeping chamber and having all sweeping done under moist conditions. Individuals sensitive to horse hair, hair dander, or other animal epidermal emanations need but avoid such animals and their environments to remain free from symptoms. Feather sensitization is relieved by the removal of feather pillows, feather mattresses, feathers from trophies, etc. Individuals sensitive to the pollen of various grasses, flowers, trees, weeds or plants should avoid coming into contact with or in the immediate vicinity of the latter. They should be removed from in and around their immediate environment. Due to the fact that the pollen are carried many miles by the wind, living or sojourning at the seashore during the pollinating season where the winds are from the ocean may be helpful to many hay fever patients. It may not, however, be possible for one or several reasons to follow the previously mentioned suggestions. It is on this account that various scientific methods of desensitization are practiced with the thought in mind of decreasing the sensitization to a specific substance or entirely remove this allergy for varying periods of time or even altogether.

Air Conditioning and New Devices

Air conditioning has been practiced for many decades but it is only recently that satisfactory systems have been developed for heating, cooling, circulating and humidifying the air not only in manufacturing plants, in hotels, theaters, restaurants, department stores and other mercantile enterprises, in vehicles of transportation as steamships, railroad cars, etc., but also in apartment houses and our homes. The cost of the available equipment is moderate, is either automatic or so simple in construction as to be readily operated by anyone. The modern air conditioned environment makes possible air in the atmosphere of desired temperature, humidity, etc. It thus becomes possible in manufacturing plants to carry on any process regardless of seasonal or outside weather conditions, thus making available all year around schedules of production if necessary. Properly con-

trolled atmospheric conditions at home or while at work, as air-conditioning becomes more widespread, will result in a marked decrease of various ailments and in the discomforts experienced today. A general adoption of satisfactory air conditioning apparatus will open a vast field of social, health and economic betterment.

Ion Regulators

You are familiar with the fact that different climates are frequently advocated as being more beneficial to health or better adapted to aid in ridding the body of certain ills. It is possible as has been suggested that the ion content (the electrical conductivity or ionization) of the air may be the important factor accountable for any beneficial biological effects on human health. More recently, striking therapeutic effects have been obtained with patients suffering from certain ailments by placing them in environments where they inhale air charged with a definite and known ion content. It has also been shown that occupied rooms have fewer ions than unoccupied rooms or as found outdoors.

Perhaps the electrical conductivity or ionization of the air may soon take its place alongside of pressure, temperature, radiation and humidity, as an important physical factor to be present in the atmosphere. Perhaps an ion-regulator will be added to the heating, refrigerating and humidifying equipments that promise to air-condition the buildings of the future and to make indoor atmosphere every day a spring day.

Eupatheoscope

The eupatheoscope is one of the more recently introduced and new scientific instruments that may be added to the others already available to record one of the important physical factors which concern our health and comfort in any environment. Eupatheoscope comes from the Greek word meaning "good-feeling indicator" and as the latter name signifies the instrument actually performs such service. It does not measure the mere temperature or the moisture which is present but goes further and records the rate at which heat is being lost in any environment. It is therefore apparent that the air movements or the continual circulation of the air are also taken into consideration by the use of this new apparatus. The amount of heat escaping is measured by an electric unit present in this instrument. Perhaps in the future by the use of the latter we may learn more

about our environments and then devise better methods of controlling the latter for our greater comfort.

Mention should be made, however, that the eupatheoscope or any other instrument available is not able to measure the rate at which individual human bodies lose heat or the amount of heat which each human body is able to generate. These are individual factors which we must not lose sight of and which in the final analysis may account for certain characteristics in our individual behavior. Two engines of the same make may reveal the fact that combustion in one is rapid and in the other slow. One human being when at rest may generate sufficient heat to replace that which is lost and in an environment provided with the average essential requirements for good ventilation as previously mentioned he may feel perfectly comfortable, while another individual under these same conditions may need heavier clothing or protection by covers against the outside atmosphere as the latter may be removing more heat from his body than he can manufacture. Perhaps some day after we know more about the metabolic processes going on in the human body, science may be in a position to take care of this variance in heat generation and heat loss in individuals so as to perhaps conquer an additional important element in its attempt to do everything possible to make living more comfortable and worth while.

Rest and Pain—About the middle of last century, a very philosophically minded surgeon, James Hilton, wrote a remarkable book, now too much neglected, entitled "Rest and Pain." He pointed out that rest was nature's method of cure for many ailments, and that pain was a method of securing rest. One might almost modify a well-known phrase and say "While there is pain there is hope." Not infrequently, when the vital forces are giving up a hopeless conflict, pain ceases. Unfortunately, although pain is nature's danger signal and imperative demand for rest, it is not perfectly adapted to its end. Here let me put forward what I believe to be an important law of life: the response to an abnormal stimulus is never so perfectly adapted as the response to a normal one; if it were, in the course of evolution the abnormal response would replace the normal one.—(Brown, W. L.: "Rheumatism and Arthritis as a Public Health Problem," *J. State Med.*, 61:249 [May] 1933.)

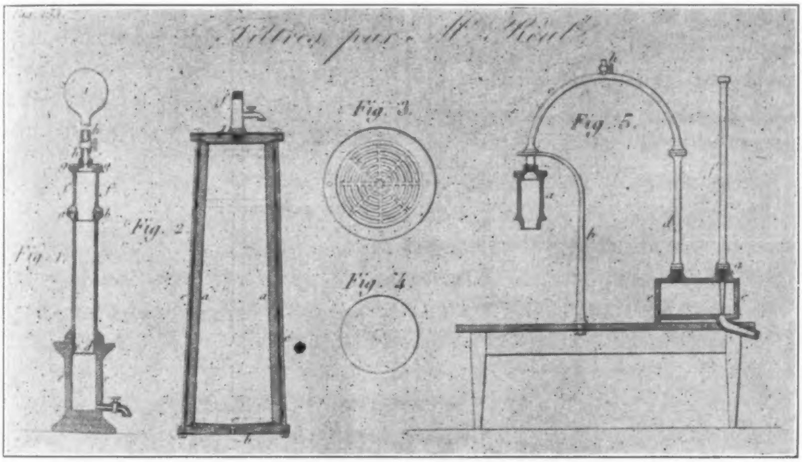
STUDIES IN PERCOLATION*

(*Continued From the May Issue*)

By Milton Wruble

1. Réal's "Filtre-presse" and Its Modifications

THAT the apparatus for which Réal [1] was granted a patent in 1815 should have had its precursors [2] goes without saying. However, it is with this date that the process, now commonly designated as percolation, received wide attention on the part of pharmacists. Hence it is with this patent description [3] that the story of percolators may make its debut.



THREE TYPES OF "FILTRES" PATENTED BY RÉAL IN 1815.[3]

Fig. 1—Cross-section of a "filtre forcé" for small operations.

A tin cylinder a, b, c, d (with diaphragm at c, d), containing the material "to be analysed," and receiver e. The reservoir i contains the solvent.

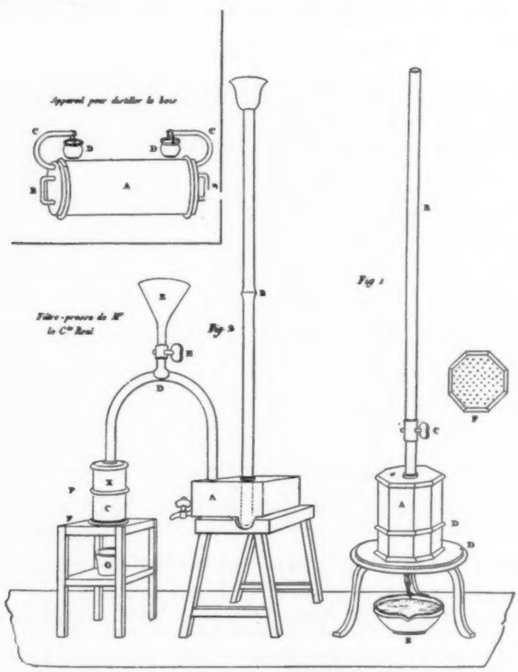
Fig. 2—That of a larger apparatus made of wood. Figs. 3 and 4 are diaphragms used in connection with this larger apparatus.

Fig. 5—That of another small apparatus for extraction under pressure. The pressure is attained by means of a column of water or mercury in tube f.

Réal's patent apparently attracted considerable attention. Under date of February 23, 1816, Doebereiner, in Jena wrote to Van Mons: "Count Réal, who lately spent a few days with me, has invented an instrument for the extraction in the cold way of substances of the organic kingdom, which is very ingenious, simple and convenient." [4]

*Wisconsin Pharmaceutical Experiment Station.

In his communication he not only describes the apparatus but also records the results of several experiments with quassia, etc. It may be assumed that Réal gave these demonstrations with an apparatus which, in all probability, he carried with him for this purpose. Trommsdorff, the editor of the *Journal der Pharmacie,* also other editors of contemporary German journals, gave space to the description of apparatus and to the recording of results obtained by the new process.[5] In Germany, Rommershausen not only introduced what he regarded as improvements, but had the modified Réal apparatus patented.[6]



FILTRE-PRESSE DE Mr. LE Cte. RÉAL AS DESCRIBED BY CADET.[8]

Fig. 1—The body of the extraction apparatus A is made of tin the top of which, being screwed on, can be removed. It is supported on a tripod. At D and D are two false bottoms F, between which the material that is to be extracted is packed. Into the cover of the apparatus the pipe B, which may be 50 to 60 feet high is fitted. The communication between B and A can be stopped by means of the stop-cock C. The dish E under the tripod receives the extract.

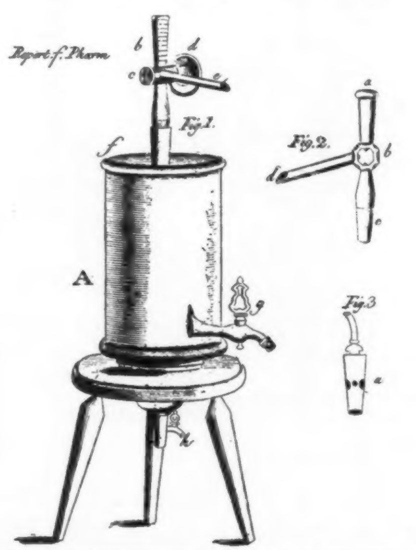
Fig. 2—The extraction apparatus C is provided with perforated bottoms at F and F between which the powdered drug is packed. The solvent is admitted to the space X by pouring it into the funnel E. The extract is collected in the container G. The pressure is secured by filling the cast-iron container A with mercury. After the apparatus C is charged with drug and solvent, the stop-cock H is closed and the pipe B also filled with mercury, which then forces the menstruum through the finely powdered and firmly packed drug.

Such modifications of the Réal apparatus as became known by distinctive names will receive special attention under the names of their inventors.

The essential feature of Réal's invention is to subject the comminuted drug to the action of the solvent under pressure, the latter resulting from a column of the menstruum (*e. g.*, water) or produced more conveniently by a correspondingly much shorter column of mercury.

In France it was C.-L. Cadet,[7] one of the editors of the *Journal de Pharmacie,* who became distinctly interested. As early as April, 1816, he gives an illustrated description of two apparatus[8] which, though differing somewhat from those described by Réal himself, are designated "Filtre-presse" of M. Réal.[9]

Buchner not only comments on Cadet's short article[10] but a year later reports on an apparatus[11] which Dr. Dingler had made for him by the watchmaker and mechanic, Sebastian Mueller, both of Augsburg. In the same year, Semmelbauer substitutes air



WURZER'S MODIFICATION OF RÉAL'S FILTER PRESS.

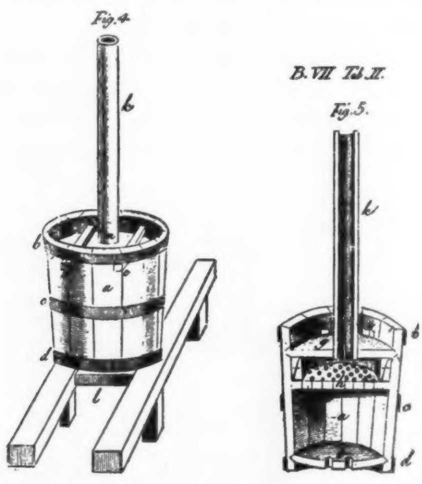
Fig. 1—Perspective of the complete apparatus.
A. The extraction cylinder.
b. The tube with the Senguerd stopcock (c, d) into which the upright pressure tube (not indicated) fits.
h. Stopcock for percolate.

Fig. 2—Adjustment of the Senguerd stopcock.

Fig. 3—The Senguerd stopcock.

pressure for the column employed by Réal.[12] In 1819, Doebereiner discusses the theory of the action of the "Realsche Aufloesungspresse."[13] In 1819 Hagen informs Buchner that the Réal apparatus is used in several apothecary shops in Koenigsberg and that it is used by his son wherever possible.[14] In the same year Wurzer suggests several improvements, viz., 1, the application of faucets below and above the extraction cylinder, and 2, the use of a Senguerd stopcock in connection with the pressure pipe to allow the liquid remaining therein to flow out without coming in contact with the exhausted drug.[15]

In the same year Brandes describes a home-made apparatus.[16]



BRANDES' MODIFICATION OF RÉAL'S APPARATUS.

Fig. 4—Shows the apparatus in perspective. Fig. 5, gives a sectional view thereof.

a. A wooden tub, the bottom of which is covered with a cloth and the holes in which may be stopped with corks.

h. Perforated diaphragm above drug to be extracted.

k. Pressure pipe.

Geiger, as editor of the *Magazin fuer Pharmacie,* describes his modification[17] of the Réal press for which he claims simplification of construction and manipulation.

He also describes Beindorf's improvement (Fig. 2) of the Réal press in accordance with which the apparatus is mounted in such a way that it can conveniently be tipped for filling and emptying.

These accounts of Réal's apparatus and modifications thereof, also subsequent accounts of Romershausen's and Beindorf's apparatus reveal the interest shown in Réal's patent and the application of his apparatus to pharmaceutical processes. Apparently, it was in 1833, that a reaction set in. It was at this later date that the two Boullays, *père et fils,* point out that the apparatus was but little used in France because of its inconveniences. Moreover, the disadvantages, the long pressure tube and the otherwise unnecessary strength of the extraction apparatus, also the difficulty to procure tight joints, are all due to the pressure which is unnecessary. Furthermore, they point out that the *cafetière* of Dubelloy, on which the Réal filter press is based, has all of the advantages of the latter and none of its disadvantages.

Thus the first chapter in the history of percolation was closed.

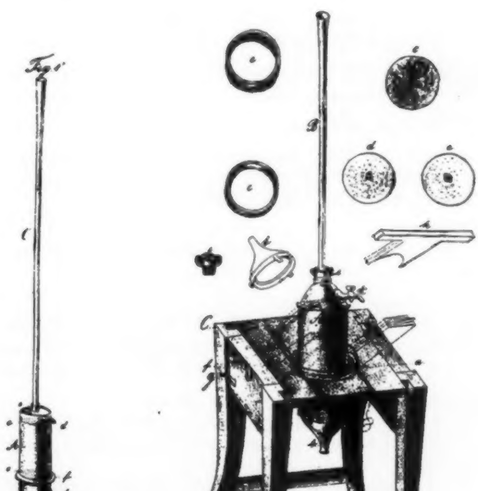


Fig. 1—Geiger's Modification of the Réal Press.
A and B. Cylinders of tin plate fitting into each other.
C. Pressure tube.
cc. Removable sieves.
d. Tube for removing any menstruum remaining after extraction.

Fig. 2—Beindorf's Modified Réal Press.

REFERENCES

1. Count Pierre François Réal was born in 1757 in Chatou near Paris. Although he was mainly a manufacturer of liqueurs, he also took active part in governmental affairs holding a number of important positions and at one time was Prefect of Police. During the French Revolution he took an active part, but later was given the title of count by Napoleon. In 1815, after the downfall of Napoleon, he was banished and opened a large distillery in Belgium. Apparently, it was shortly after his banishment that he visited Doebereiner in Jena, for it was under date of February 23, 1816, that the latter wrote to Van Mons.[4] Having lived in Brussels, Antwerp, and New York, where he established a factory for purifying fish oils, he returned to Paris in 1818 and lived as a private citizen until his death in 1834. Hoefer, *Nouvelle Biographie Générale* (1862).

2. Thus in 1813 Benjamin Thompson (Count Rumford) had described an apparatus for the "percolation" of coffee. Tilloch's *Philos. Mag.* 41, p. 108. See also *Complete Works of Count Rumford,* vol. 4, p. 617, published in 1875 by the Academy of Arts and Sciences.

Gilbert, the editor of the *Annalen der Physik,* goes back still farther. In a "Zusatz" to Doebereiner's article (*Ann. d. Phys.* 60 (1819), p. 17) he states: "Herr Réal scheint auf sie gekommen zu seyn durch die Bramah'sche Wasserpresse." J. Bramah, a mechanical engineer and inventor, perfected a hydraulic press in 1795. (*Dict. Natl. Biogr.* 6, p. 202.) The Boullays, some years later, claimed that the principles underlying the Réal press had been previously employed in the cafetière of Dubelloy (*Journ. de Pharm.* 25 (1833), pp. 289, 422).

3. *Brevet D'Invention de Cinq Ans, pour un Appareil de Filtres, au Moyen duquel on parvient à obtenir. . . .* (*Brevet* No. 645, 1815.)

4. Tilloch's *Philosoph. Mag.* 47 (1816), p. 216.

5. To what extent the Réal invention attracted attention will become apparent from the following lists of items found in several contemporary journals during the first decade, *viz.,* from 1816 to 1825, inclusive:

Journal de Pharmacie.

1816. T. 8, p. 468. C. L. C(adet), Essai du filtre-presse de M. le Comte Réal.

Trommsdorff's Journal der Pharmazie.

1816. Bd. 25 (St. 2), p. 47. J. B. Trommsdorff, Nachricht von der Erfindung des Grafen von Réal organische Substanzen kalt zu extrahiren, nebst Beschreibung eines solchen Apparats.

Trommsdorff's Neues Journal der Pharmacie.

1817. Bd. 1 (St. 1), p. 24. J. B. Trommsdorff, Neue Versuche mit der Réalschen Extraktionmaschine, vorzueglich in pharmaceutischer Hinsicht.

1817. Bd. 1 (St. 2), p. 458. J. W. Doebereiner, Die Réalsche Aufloesungspresse, in welcher Quecksilber die pressende Fluessigkeit bildet.

1818. Bd. 2 (St. 2), p. 422. Auszuege aus Briefen an den Herausgeber, from the letter of J. C. C. Schrader.

1819. Bd. 3 (St. 1), p. 453. Auszuege aus Briefen an den Herausgeber, from the letter of E. Romershausen.

Schweiggers Journ. f. Chemie u. Physik.

1816. Bd. 16, p. 339. J. W. Doebereiner, Graf Réal's neuer Apparat zur Extraktion organischer Substanzen.

Berlinisches Jahrbuch f. Pharmazie.

1817. Bd. 18, p. 260. C. W. K(astner), Réal's Presse.

1819. Bd. 20, p. 392. C. W. K(astner), Die Luftpresse.

Buchner's Repertorium f. d. Pharmacie.
1817. Bd. 3, p. 380. J. A. Buchner, Beschreibung der Réalschen Aufloesungspresse.

Dinglers Polytechnisches Journal.
1821. Bd. 5, p. 385. Marechaux, Ueber die Fortschritte in dem Verfahren, die Extractionsstoffe der Vegetabilien vermischt oder abgesondert zu erhalten. (Réalsche- und Romershausensche Pressen.)

Magazin f. Pharmazie.
1825. Bd. 9, p. 176. Ph. Geiger, Die Réalschen and Romershausenschen Pressen. . . .

6. Buchner, *Repert. d. Pharm.* 6 (1819), p. 316.

7. Charles Louis Cadet de Gassicourt was born in 1769. He studied law, but after the death of his father, L. C. Cadet, in 1799, he took over the family pharmacy. During the Napoleonic wars, he was military pharmacist in Germany. He was one of the founders of the *Bulletin de Pharmacie* (1809), which since 1815 is better known as the *Journal de Pharmacie,* being also one of its editors. He wrote a *Dictionnaire de chymie,* also a *Formulaire magistral.* In addition, he contributed numerous articles to journals. He died in 1821, six years after Réal had been granted his patent. Hence the period during which he could be interested in the subect of percolation was but a brief one.

8. *Journ. de Pharm.* 8 (vol. 2 of new series), p. 165.

9. It may be worth while to note that whereas Réal himself labels his apparatus a "Filtre," Cadet designates it "filtre-presse."

10. *Repert. der Pharm.* 2 (1816), p. 356; see also p. 362.

11. *Repert. der Pharm.* 3 (1817), p. 74.

12. *Repert. der Pharm.* 3 (1817), p. 88.

13. *Annalen d. Physik* 60 (1819), p. 14.

14. *Repert. der Pharm.* 5 (1819), p. 414.

15. *Repert. d. Pharm.* 7 (1819), p. 230.

16. *Repert. der Pharm.* 7 (1819), p. 234.

17. *Mag. f. Pharm.* 9 (1825), p. 181.

SOME EFFECTS OF HEAT ON CHLORAMINE T, U. S. P.

By Geo. E. Éwe

THE U. S. P. X states that "at about 95-100° C. Chloramine loses its water of crystallization without decomposition." When several grams of Chloramine was heated at 95-100° C. until constant in weight its available chlorine content increased proportionately, thus verifying the above U. S. P. statement. But Chloramine must not be heated longer than necessary to just deprive it of water, otherwise decomposition sets in. When Chloramine was heated at 95-100° C. two or three times the length of time required for dehydration, loss of from 10 to 12% of its available chlorine resulted, it became yellowish and less readily soluble in water and sometimes showed partial melting at this temperature.

And, although Chloramine itself, in small quantities, will withstand a temperature of 95-100° C. for a limited time under certain conditions it will often decompose at much lower temperatures when in admixture with certain substances with which it is often associated in pharmaceutical products or when the heating is prolonged.

Chloramine mixed with 18% of common salt and dampened with water, then spread out in a layer about 1 inch thick on Manila paper, placed on iron wire trays in a drying closet heated by steam coils (the air in the closet being circulated naturally and not forced by fans), decomposed suddenly to a blackish, charred, porous mass, throwing off dense, stifling fumes, but without setting fire to the Manila paper, although the latter was slightly charred. No flame was observed. The temperature attained before the decomposition took place was not observed.

Upon another occasion a mixture similar to the above, but containing 1% of powdered acacia in addition, was dampened with water and spread out in the same way, but in a drying closet heated by circulating hot air (the air being heated by steam pipes in a separate unit) when it suddenly decomposed with the same results as mentioned above. In this case, also, the temperature at which the decomposition took place was not observed, but this drying closet on other occasions had never registered temperatures higher than 85° C. "Acacia is acidic, normally, and therefore if it is to be used, the Chloramine or the mixture should contain enough alkali to offset the acidity of the acacia, otherwise it is likely to induce decomposition, particularly in the course of the drying process. This has been observed by

at least three manufacturers." (L. A. Watt, Monsanto Chem. Works, Private Communication.)

Upon still another occasion a mixture of Chloramine with 18% of powdered Rochelle Salt, dampened with water, was being dried in the same way as that mentioned in the preceding paragraph when the same type of decomposition described above occurred.

It should be noted here that the above-mentioned operations had been repeatedly performed on former occasions without any such untoward result. It was not possible to ascertain the degree of dehydration attained by the above mixtures at the time of the decomposition, but it is not likely that this was greater than similar batches on former occasions which showed but little dehydration under the same conditions.

The Chloramine used in the above cases answered all U. S. P. requirements.

Consequently, it would seem occasionally hazardous to dry large quantities of such Chloramine mixtures with any considerable degree of heat.

Some tablets of Chloramine made with 18% of common salt as diluent were declared by a purchaser to be "insoluble." The tablets had a grayish-brown tint and dissolved to the extent of only about 50% after twenty-four hours in water with occasional shaking, and failed to yield available Chlorine, even after acidification. The control sample tablets representing this batch of tablets were pure white, dissolved readily in water and yielded the normal proportion of available Chlorine. The complained-of tablets were 1½ years old and had evidently been subjected to storage in an excessively warm location since this defective condition could be duplicated in this laboratory by placing a bottle of Chloramine tablets, which were normal in every respect, about ½ inch away from the side of a hot-water heat radiator, a thick piece of cardboard being placed between the bottle and the radiator to prevent direct contact. After several weeks these tablets took on a grayish-brown tint, were much less readily soluble (about the same as the complained-of tablets) and yielded absolutely no available Chlorine.

Chloramine tablets made with either 18% of common salt or 18% of Rochelle Salt as diluent are quite stable, only one exception having been observed. This exception was a batch of tablets of Chloramine made with 18% Sodium Chloride as diluent. This batch assayed 4.56 grains of Chloramine (12.25% active Cl content) when

made. They were stored in flint glass corked bottles in the dark at room temperature. After two years, eleven months the tablets were pale brownish in color, showed only surface solution when shaken occasionally for 24 hours in excess of water and yielded absolutely no active Cl even upon acidification of a solution, made by crushing a tablet and dissolving it in 10 cc. water.

As is to be expected Chloramine is invariably decomposed when heated for any length of time above 100° C. At slightly above 100° C. it often appears to remain unchanged but will be found upon examination to have become much less readily soluble in water and to afford much less, if any, available Chlorine. "Any discoloration, even the slightest detectable yellowing, as compared with the normal whiteness of the material, is evidence of decomposition." (L. A. Watt, Monsanto Chem. Works, Private Communication.)

When Chloramine was heated in a glass cup in an electric oven it suddenly and quietly puffed up to the charred mass mentioned above when the temperature had reached about 112° C. Chloramine mixed with 18% of common salt showed this same behavior at about 110° C., while a mixture of Chloramine with 18% of Rochelle Salt also showed it at about 112° C.

A mixture of Chloramine with 18% of powdered potassium nitrate also showed this same behavior but a temperature of about 116° C. was attained before the decomposition took place and the reaction was midly explosive.

When the Chloramine or the various mixtures mentioned above were heated on Manila paper in glass cups the temperatures at which decomposition occurred were about the same as without paper. When heated in a porcelain crucible Chloramine melted, then suddenly charred and swelled up to a porous mass. It did not burn with flame unless external heat was applied. When so heated whitish vapors arose which appeared to be volatized Chloramine since crystals formed on a cold surface held in the vapors. When a flame was applied to the vapors it did not "burn back" to the powder.

Chloramine could not be ignited by "brushing" the powder with a Bunsen flame nor by plunging a red-hot wire into it, so that it seems unlikely that a spark of static electricity could ignite it.

In the U. S. P. X method of determining melting points Chloramine became damp from liberated water of crystallization and melted between 176-179° C. to a light-brownish, opaque mass, but did not char nor deflagrate at this temperature.

It has been suggested that "there seems to be rather a critical point so far as stability is concerned when a portion of the water of crystallization is removed. We do not know just where this point is, but from experience would not recommend handling a product containing less than 2 mols. of water, or in round figures, a loss on drying of 12 to 13%." (Private Communication, L. A. Watt, Monsanto Chem. Works.) To test out the effect of the state of hydration upon the stability of Chloramine two methods of dehydration were employed. One method consisted of drying several grams of the Chloramine at 95-100° C. until just constant in weight. Repeated trials of this method resulted in no decomposition the Chloramine losing from 18.5 to 18.7% in weight and the dried Chloramine merely increasing proportionately in available Chlorine content. The second method consisted of keeping 10 grams of another lot of Chloramine in a Petri dish in a sulphuric acid desiccator until constant in weight (3 months). No decomposition resulted, the Chloramine merely losing 18.25% in weight and the dried Chloramine increasing exactly proportionately in available Chlorine content as in the first method.

Therefore, the effect of the state of hydration of Chloramine upon its stability is problematical, but does not seem to be a very potent factor, if any, in view of the results of the experiments recorded above. However, Mr. L. A. Watt of the Monsanto Chem. Works, in commenting upon this phase of the subject expresses the following opinion in a private communication:—"Although the Chloramine may be dried either in a desiccator or in an oven, without any evidence of decomposition; local overheating, or a speck of contaminating material in the dried product may start decomposition, whereas, the same speck of contaminating material in the hydrated product would have no effect. It is our experience and we believe it has been confirmed by others who have handled the material in quantity, that it is best not to drive off more than about 7% of the possible 18 to 18½% (theoretical 19.17%) water of crystallization."

Incidentally, it is interesting to note that Chloramine gives up its water of crystallization fairly readily since it was rendered anhydrous at room temperature in a sulphuric acid desiccator, and also that the water of crystallization content of the two samples referred to in the preceding paragraph was 18.6 and 18.25%, respectively, the theoretical proportion being 19.17% for the three molecules of water required by the U. S. P.

Very little information on the subject of the stability of dry Chloramine could be found. The U. S. P. X states that it "slowly decomposes on exposure to air, losing Chlorine" and that "at about 95-100° C. Chloramine loses its water of crystallization without decomposition." Merck's Index states that it "decomposes in moist air" and "melts at 160-185° C. with decomposition." "Notes on the manufacture of Chloramine-T Tablets" (Monsanto Chemical Works) states "at no time should Chloramine-T be subjected to a temperature higher than 105° F."

Whether the occasional instability shown by Chloramine is inherent in the substance itself or is wholly due to external influences remains to be ascertained. It is certain that heat is a factor in the decomposition, and the effect of admixture with other substances always requires careful consideration in each individual case. The following incompatibilities are listed in "Notes on the manufacture of Chloramine-T Tablets" (Monsanto Chem. Works):—"dirt," all acids or substances of acidic nature, organic matter, contact with metals (when moist), ammonia fumes and salts, alcohol, sugar, soluble soap, glycerin and sodium citrate. The same "Notes" list the following as being compatible:—Sodium Bicarbonate, Sodium Carbonate, Rochelle Salt, borax, Sodium Benzoate, soluble saccharin (compatible for at least six months), Sodium Chloride, soluble starch, Zinc Oxide, Zinc Stearate and purified talc. As stated above, the effect of the state of hydration of Chloramine upon its stability, if any, is problematical.

Conclusion

The above data indicate that Chloramine and its mixtures may occasionally show instability under certain conditions and methods of handling. Fire hazards may possibly arise from the injudicious use of heat in drying Chloramine products during manufacture and prolonged application of even mild heat as well as admixture with certain incompatible substances spoil pharmaceutical products containing Chloramine.

Consequently, it would seem advisable to avoid incompatibilities, to use but a minimum of heat, if heat is found necessary, in the manufacture of Chloramine products and to store the finished products in a cool place (or at least where the temperature never rises above room temperature).

(Research Laboratories, Tailby-Nason Company, Boston, Mass.)

TARTRATE SUBSTANCES USED IN BAKING POWDERS

By Simon Mendelsohn

Chemist, The Snow King Baking Powder Co., Cincinnati, Ohio

BAKING POWDERS of the cream of tartar or tartaric acid types constituted one of the staple commodities of the manufacturing and dispensing pharmacist many years ago. This circumstance was readily justifiable inasmuch as all of the ingredients of these types of leavening compounds were commonly available for use in the pharmaceutical practice of that period.

Hart [1] citing Morrison,[2] attributes the introduction of cream of tartar baking powder to the pharmaceutical firm of Hoaglands, of Fort Wayne, Indiana, in 1868. According to Bailey,[3] however, the first formulæ for tartrate baking powders were developed in the United States, a cream of tartar preparation having been sold by the firm of Preston & Merrill, of Boston, as early as 1850. In 1853, Vincent C. Price, of Troy, N. Y., is alleged to have compounded a leavening preparation consisting of cream of tartar, and soda, with starch or flour as a stabilizing constituent, and the first reference to baking powder in technical literature was cited in 1855 in the *Archiv. d. Pharmacie.*[3] Dr. Price at Waukegan, Illinois, in 1865, established a remunerative trade in cream of tartar baking powder, and according to Bailey [3] was then followed by the Hoaglands previously mentioned.

Bennion and Stewart,[4] on the other hand, cite the period 1845-1850 as marking the introduction into the United States, of ready mixed aerating media containing tartaric acid and/or cream of tartar. As a point of historical note, conspicuous posters were then displayed to attract attention to the so-called "German Yeast" or "Baking Powder." The interests of economy eventually dictated encouragment of research toward replacement of tartaric acid and cream of tartar in particular, by equally appropriate acid substances of lower cost.

With the use of cream of tartar in leavening compounds having been established for about a decade, adulteration was already being more or less extensively practised as attested by the correspondence here reproduced.[5]

"THE ADULTERATION OF CREAM OF TARTAR.—Now that cream of tartar has become an article of the cuisine, the larger part used being as a substitute for yeast in bread and cake making, the rascals who are constantly seeking out some means of cheating the public, have laid hold of this, disregarding the fact that it had already suffered sufficiently among the druggists.

The following note reveals a specimen of this villainy, which exhibits some acuteness, as the party addressed himself to a class who either ignorantly or from habit would be induced to accept the bait:—

Philadelphia, August 22d, 1859.

To the Editor of the American Journal of Pharmacy:

The sample is part of a specimen of an article which was offered in our market within the past fortnight, under the name of 'Cream of Tartar Adulterator.' The parties offering it for sale do business in New York, as dealers in spices and grocery articles. The article was not offered to the wholesale druggists, but to spice and drug grinders in this city, at from 5 to 8 cents per lb.

An examination of the article shows it to be sulphate of lime, containing a little sulphate of soda. Under the glass it has the appearance of translucent gypsum ground to a similar fineness as cream of tartar. It presents near the same appearance as cream of tartar of a damp powder, with points reflecting light, though the color is whiter than is usual with cream of tartar; though not calculated to deceive an adept, it would, when mixed with cream of tartar in proper proportions, pass the observation of most buyers.

Very truly yours,

CHARLES BULLOCK."

The presence of excessive lead in tartaric acid and cream of tartar constituted the basis of early objections [6] to the use of these media in baking powders. These criticisms are no longer tenable in view of superior improvements in chemical technology and the rigid supervision imposed by regulatory agencies.

Tartaric acid being readily soluble in water,[7] reacts immediately with sodium bicarbonate in baking powder, in the cold and thereby liberates carbon dioxide according to the reaction,

$$H_2C_4H_4O_6 + 2\ NaHCO_3 \rightarrow Na_2C_4H_4O_6 + 2\ CO_2 + 2H_2O$$

which proceeds with avidity conducive to an irregular evolution of gas throughout a mass of dough. Tartaric acid being hygroscopic, yields baking powders characterized by a relatively indefinite stability. Normal sodium tartrate constituting the residue in the above reaction, is decidedly aperient in its nature.

The use of acid potassium tartrate (cream of tartar) as the acid reactant in leavening compounds is hardly economical, since only half of the acid in combination is available. Reaction velocity of cream of tartar with sodium bicarbonate is considerably retarded in the cold, whereas CO_2 is readily evolved at oven temperature. These differences are manifestly due to the solubility characteristics of the acid tartrate in cold and hot water, respectively.[8]

In the reaction between cream of tartar and sodium bicarbonate,

$$KHC_4H_4O_6 + NaHCO_3 \rightarrow KNaC_4H_4O_6 + CO_2 + H_2O$$

the residual potassium-sodium tartrate constitutes the saline aperient, Rochelle Salts commonly employed in medicine.

Tartrate ions, in promoting peptization of egg and flour proteins, tend simultaneously to contribute a fine grain and whitening effect, as exemplified in the case of "Angel" cake. This phenomena can be attributed to the fact that the pigments of flour are cream colored in slightly alkaline environment, and white in the presence of acid.

Dilatory activity in the case of the cream of tartar baking powders ordinarily necessitates the intervention of tartaric acid to accelerate the reaction with the alkaline carbonate constituent.

Crystalline tartaric acid of particle size 0.1-0.5 mm. coated with paraffine, has been advocated for use in baking powder. The paraffine or other protective substance is intended to minimize the hygroscopicity of the acid, and is applied by treatment with the melted material in a rotary drum.[9]

Efforts have in the past, been directed toward the synthesis of the acid on a commercial scale, but the processes thus far devised, have proven to be impractical, from the standpoint of industrial feasibility.

The most recent synthesis was developed by Stokes & Peters, who utilized the oxidation of carbohydrates for the production of tartaric acid (and tartrate substances) from starch.[10] The reaction has also been been applied for the conversion of dextrose, sucrose, and cellulose to tartrates. Formation of small quantities of tartrate substances incident to the oxidation of carbohydrates by nitric acid has long been known, but the methods heretofore suggested, resulted in small yields of tartrates associated with saccharic and oxalate compounds. Difficulties thus imposed, precluded the satisfactory oxidation of carbohydrates on a commercial basis. Stokes & Peters developed a method subject to a definite control whereby the carbohydrate oxidation can be conducted without the formation of

saccharic and oxalic acids, and with yields of tartaric acid sufficient to warrant commercial success.[10] This process depends upon an obscure phenomenon induced through the non-catalytic intervention of manganese chloride in a mixture of the carbohydrate, nitric acid, and water. Certain observations suggest that the manganese chloride may inhibit or retard the formation of oxalic acid and in somewhat lesser degree, saccharic acid, thereby increasing the development of tartaric acid.

Carbohydrate, water, and manganese chloride [11] in proportions of 100, 100, and 20 [11] parts, respectively, are mixed and treated with 100 parts of strong nitric acid added in small portions to avoid violent reaction. These substances are preferably allowed to stand at room temperature until the mixture attains the proper consistency and homogeneity, then heated with constant stirring to 90° C. The reaction being initiated at this temperature, the heating may then be discontinued. Within 15 minutes the mixture assumes a darker color, at which stage 100 parts more of nitric acid are added, and the entire again heated to 90° C. The mixture subsequently becoming darker within 30 minutes to 1 hour, is treated with another 100 part portion of the acid, heated to 40°-50° C., and maintained at this temperature for 40-50 hours.

Further treatment depends solely upon the form of tartrate substance desired. For cream of tartar (acid potassium tartrate), the mixture is diluted with water, neutralized with an alkali, *e. g.*, potassium carbonate, the precipitated manganese hydrate removed by filtration and the solution finally acidulated with acetic acid.

If tartaric acid is required, the mixture is rendered alkaline with soda-ash, boiled, the manganese hydrate precipitate removed by filtration, and calcium chloride added to form calcium tartrate. This may finally be obtained by filtration and subsequently decomposed to liberate the tartaric acid.

Schneider & Rahn,[12] recommend the use of neutral calcium tartrate as an acid-reactant in baking powders for the liberation of CO_2 from sodium bicarbonate. The tartrate may be used in combination with calcium lactate, secondary calcium phosphate, or both.

$$CaC_4H_4O_6 + 2NaHCO_3 \rightarrow Na_2C_4H_4O_6 + CaCO_3 + CO_2 + H_2O$$

Meso-tartaric and racemic acids as well as certain isomeric anhydrides of tartaric acid or their modifications have been suggested as possible substitutes for potassium acid tartrate in baking powders.[13] Racemic acid, $(CH[OH].COOH)_2 + H_2O)$, in particular, is held

to react more efficiently than cream of tartar with sodium bicarbonate. Leavening activity is cited as being far more moderate, with considerably less irregularity in the evolution of CO_2 than is the case with d-tartaric acid. Owing to the tendency of racemic acid toward efflorescence, any aerating mixture containing this acid should exhibit superior keeping-qualities despite exposure to extreme humidity.[13]

Dehydrated racemic acid being supposedly capable of re-hydration, the material would consequently serve as a drying agent upon the other intimately associated constituents of a baking powder. All of these satisfactory qualifications are to a great extent equally applicable to meso-tartaric acid, $([OH]_2.C_2H_2[COOH]_2 + H_2O)$. This isomer, while considerably more soluble than racemic acid, is less so, than d-tartaric acid. Di-acid salts of the non-dextrorotary tartaric acids, *i. e.,* di-mesotartrate, di-racemate and di-d-tartrate, and mixtures of these, have been subject to investigations as to possible advantages in the role of acid reactants in leavening preparations.

Structural Characteristics of Tartaric Acid and Its Isomers

COOH	COOH	An equal mixture of the d + l types constitutes the inactive d-l tartaric acid	COOH
|	|		|
H—C—OH	HO—C—H		H—C—OH
|	|		|
HO—C——H	H——C—OH		H—C—OH
|	|		|
COOH	COOH		COOH
(d-tartaric acid)	(l-tartaric acid)	(racemic acid)	(meso-tartaric acid)

The l-type can be obtained by the resolution of racemic acid into its active isomers, *i. e.,* the d- and l-forms; racemic acid can be prepared by boiling the d-acid with NaOH.

Meso-tartaric acid, originally prepared by Pasteur through a transformation effected by heating the cinchonine salt of d-tartaric acid, cannot be resolved into d- and l-forms.

Anderson, and co-workers investigated the qualitative reactions of tartaric acid and its isomers for the purpose of devising a quantitative procedure for the estimation of these substances in baking powders.[14]

Fenton's reaction,[15], [16], wherein a tartrate treated with ferrous sulphate and hydrogen peroxide in the presence of sodium hydroxide responds with a violet coloration, was subsequently adopted as the basis for a colorimetric quantitative technic.[14] Interesting phenomena relative to the reactions of tartaric acid isomers and tartrates were noted in the course of investigations.

Using the color reaction of d-tartaric acid as a criterion, it was observed that l-tartaric acid, l-ammonium tartrate, and meso-tartaric acid produced corresponding shades; with racemic acid, however, the color intensity was approximately half that of the standard. This anomaly was tentatively attributed to possible discrepancies in the combination of the d- and l-forms ordinarily constituting racemic acid. Molecular weight determinations by cryoscopic method indicated no apparent malformation. Conversely, a mechanical mixture of equal parts of d- and l-tartaric acids failed to act as racemic acid, but yielded the proper color reactions. Racemic acid crystallizes with one molecule of water of crystallization, while d- and l-tartaric acids crystallize in the anhydrous form, which circumstances suggested possible differences between these ordinary constituent types in the free state.

Meso-tartaric acid also crystallizes with one molecule of water but yields, however, the same reaction as the d- and l-forms.

Important.

A subsequent paper to follow, is to be devoted to certain isomerism phenomena of the tartrates, methods of assay of these substances prior to their use in baking powders, microscopical characteristics, and tests for metallic impurities based on methods other than the pharmacopœial procedure.

(Simon Mendelsohn, The Snow King Baking Powder Co.,
Cincinnati, Ohio.)

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(3) Siebel, *Tech. Rev.* (Quarterly), April, 1931, Chicago.
(4) *Cake Making,* London (1930).
(5) *Amer. J. Pharm.* 486 (1859).
(6) Napier, *J. Soc. Chem. Ind.* 545 (1885).
(7) 139 parts per 100 of water at 20° C.
(8) 0.37 parts per 100 of cold water (0° C.); 6.1 parts per 100 of water at 100° C.
(9) German Pat. 507,399 (1926).
(10) U. S. Patent 1,870,472 (1932).
(11) The quantity of the manganese salt may vary within wide limits; if only 3 parts instead of 20 are used, the reactions yield oxalic and saccharic acids. With 10 parts of the salt, there will be no oxalic acid, but the tartaric acid will be associated with saccharic acid. Increasing the amount of manganese chloride up to 50 parts yields substantially the same results as induced by 20 parts.
(12) U. S. Patent 1,286,145 (1918); *cf.* U. S. Patent 692,451-2-3.
(13) U. S. Patent 1,214,726 (1917).
(14) *J. Ind. and Eng. Chem. Anal. Ed.,* p. 19, Jan. 15, 1933.
(15) *Chem. News,* 33:190 (1876).
(16) *Ibid.,* 43:110-11 (1881).

MEDICAL AND PHARMACEUTICAL NOTES

Paracelsus Again—Aureolus Theophrastus Bombastus von Hohenheim, or Paracelsus (1493-1541), precursor of chemical pharmacology and therapeutics, and the most original thinker of the sixteenth century, was, in spite of his bombastic assertion of rank and lineage, a striking example of the very raw materials from which such aspirations are sometimes fashioned. His coarseness of fiber, though a better possession to him than vulgarity of spirit, often impeded his power to "think straight and see clear. . . . He got his doctor's degree under Leonicenus at Ferrara (1515), and picked up an unusual knowledge of alchemy, astrology and other occult sciences from the learned abbots and bishops of the country round, as also in the laboratory and mines owned by the Tyrolese alchemist, Sigismund Függer. Having the Swiss "wanderlust," he traveled all over Europe, collecting information from every source, and by his relations with barbers, executioners, bathkeepers, gypsies, midwives and fortune tellers he learned a great deal about medical practice, and incidentally acquired an unusual knowledge of folk medicine and a permanent taste for low company.

Tannic Acid Bath in the Treatment of Burns—A three-hour bath in tannic acid during which the burns become well tanned is a feature of the modern treatment of extensive burns as described by Dr. Donald B. Wells, of Hartford, Conn., at the meeting of the American Medical Association.

The use of tannic acid relieves the pain sufficiently so that the burned areas can be thoroughly cleaned. In this way infection can be prevented. Infection alone was the cause of the exhausting illness, many of the complications and a majority of the deaths from burns in the old days, in Dr. Wells' opinion.

The person with extensive burns is placed in a large tub of tannic acid solution, according to Dr. Wells' plan of treatment.

"He receives quantities of liquids to drink, in order to balance the loss of water. As soon as his pain is somewhat relieved, several attendants begin to work. For three hours they remove burned

tissue as the solution loosens it and clean unburned areas with soap and water.

"By the time the patient is ready to be placed in bed a tan has formed over the burned portions. Then for seventy-two hours warm air is blown on him from an ordinary hair drier, while he is more or less constantly sprayed with tannic acid solution. After this the blower is used alone until the tissue has become perfectly firm, for only a little perspiration may break it and invite invasion by germs," Dr. Wells explained.

The method is especially successful in burns from gasoline explosions, ignited clothing and extensive scalds, he said. It can be used in any good hospital.—*Science News*.

SMOKING FOUND TO INCREASE CARBON MONOXIDE IN BLOOD— Tobacco smoking increases the amount of carbon monoxide in the blood of persons living under normal conditions and not exposed to obviously large amounts of the deadly gas, Dr. Alexander O. Gettler and Marjorie R. Mattice, of Bellevue and Allied Hospitals and New York Post-Graduate Medical School of Columbia University, have found.

In their report to the American Medical Association they point out that the ideal normal person should have no carbon monoxide in his blood. But the average person under ordinary conditions is exposed so frequently to the colorless killer from automobile exhausts and other places that it is not possible to regard him as being entirely carbon monoxide free, although ordinary tests for toxic amounts of the gas might not show any in his blood.

Dr. Gettler and Miss Mattice consequently used a very delicate test for extremely small amounts of carbon monoxide in blood. The blood is tested because this gas combines with blood hemoglobin, preventing the latter from playing its role of oxygen carrier, with generally fatal results. They tested the blood of persons living in New York City but exposed to minimal amounts of the gas; persons living in the country; and persons who might be exposed to the gas in the course of their work, such as street cleaners and taxi drivers.

As might be expected, the average for the carbon monoxide percentage in the blood was highest for taxi drivers, next highest for street cleaners and lowest for persons living under ideal rural

conditions. But even these persons had some of the gas in their blood.

The surprising fact was that tobacco smoking was apparently the most conspicuous factor in determining how much of the blood hemoglobin combined with the gas. The amount to which the individual was exposed seemed secondary.

One of the street cleaners, for example, worked on a street with an elevated railway over it, and fairly dense traffic composed largely of trucks, which produce more carbon monoxide than pleasure cars. He came to the laboratory after work, in his working clothes, having walked only one block from work. But of all the group he had the smallest amount of carbon monoxide in his blood. He does not smoke. In contrast, one of the cleaners who stopped in the morning on his way to work had more than the average for the group But he had smoked six cigarettes on his way.—*Science News.*

Lyman Spalding's "New Nomenclature of Chemistry"—A reproduction of Lyman Spalding's "New Nomenclature of Chemistry" has been issued by the American Pharmaceutical Association. Chemistry has its troubles in nomenclature today: students of chemical history who turn over the pages of this brochure may find consolation in reflecting that in 1799, the date on its title page, United States chemists were "arrested by the many difficulties that arise from the introduction of a new language, and from the multiplicity of synonymous terms." The full title is "A New Nomenclature of Chemistry, proposed by Messrs. De Morveau, Lavoisier, Berthollet and Fourcroy; with Additions and Improvements, by Lyman Spalding, M. B., Lecturer on Chemistry in Dartmouth University." We may remind our readers that Spalding was the "father" of the United States Pharmacopœia, and occupies a distinguished position in American medicine. The arrangement of the system is tabular, simple substances ("or such as have not hitherto been decomposed") appearing in the left-hand column, gases in the second, and "simples" combined with oxygen in various "degrees" in the next five columns. New and old names appear side by side in each column: "Oxyd of Zinc," for instance, is given as the latest name of "Calamine stone" or "Fossil cadmia," and "Sublimated oxyd of zinc" as the equivalent of "Philosophic wool, Pompholix, Flowers of zinc." Lists are also printed of acids with "compounds bases," of "combinations of oxyds

with various substances," and of "secondary or neutral salts." We understand that a few copies of this interesting record are obtainable, at $1.00 post free each, from the office of the Association, 10 West Chase Street, Baltimore, Md., U. S. A.

CLEANING SODIUM METAL—Sodium metal may be cleaned by slicing it into strips about a quarter of an inch thick, putting into a flask, covering with toluene and heating the flask until the toluene boils and the sodium melts. The metal will flow out of the film of oxide which coats it and collect in a large globule. The molten metal can be poured into a beaker. The oxide, carbonate, etc., remain in the flask. Before the sodium has time to solidify, the beaker is rotated slightly in order to break the large globule into several smaller ones of whatever size desired for the particular synthesis involved. The plastic metal may be broken up by a stirring rod into pieces of proper size if rotation is unsatisfactory. We have found it undesirable to attempt to filter the molten metal through wire gauze or glass wool. It may be siphoned directly from the flask into previously heated glass tubes if the purpose for which it is to be used demands this. Clean sodium may be secured safely and quickly by this method. The metal will tarnish less if preserved under toluene rather than kerosene as the toluene is purer and absorbs water less readily than kerosene.—*E. B. Wilson. Jour. Chem. Educ.*

PHOSPHINE FOR DEMONSTRATIONS—A method of generating phosphine for demonstrations is suggested by the fact that calcium phosphide reacts with water to produce phosphine.

A large hydrometer jar and an ordinary glass filter funnel constitute the necessary apparatus. In use, the jar is filled with water to such a height that, when the funnel is inverted in the jar, the water level is about one-half inch above the end of the funnel tube. *Lump* calcium phosphide *must* be used. A large lump of phosphide is selected, and immediately after the phosphide is dropped into the water, the funnel is placed over it. Phosphine evolves rapidly and rises, and, as it comes to the surface, ignites, forming excellent vortex rings. The funnel tube serves to collect the phosphine into large bubbles and to guide it to the surface. With experimentation, an instructor can adjust the apparatus to suit individual circumstances.—*H. M. Teeter, Jour. Chem. Educ.*

NEWS ITEMS AND PERSONAL NOTES

Earthworms as Medicine—In the "Ancient Pharmacy Collection," which will form an important feature of the professional exhibit of E. R. Squibb & Sons at A Century of Progress Exposition in Chicago, there are hundreds of drug containers of earthenware, majolica, metal and wood, many of which are of interest on account of their great rarity and beauty, and others of which will attract attention on account of the curious and unusual drugs and preparations which they once contained.

In the latter class there are several containers for medicines formerly made from earthworms.

Yes! Earthworms.

When a sixteenth century apothecary was seen in his garden digging worms it was no sign that he was going fishing. He was probably securing the "raw material" for one of his important medicinal preparations, for a number of such were employed by physicians of that and even later periods.

The earthworm was known as *Lumbricus terrenus* or terrestris in Latin.

It was used in the form of an oil, or of a spirit, and there are two containers at least, in this collection as it will be seen in Chicago, which bear labels of preparations of earthworms.

One of these containers is a half gallon earthenware jug labeled *"Ol. Lumbricori"* (oil of earthworms); the other is a small glass bottle whose label, translated, means "Spirit of Earthworms." Both of these containers will be found in the section of shelving immediately to the left of the entrance to the exhibit from the main rotunda.

Now in the days when these preparations were prescribed by physicians, there were no large scale manufacturers or supply houses and when the apothecary of that time needed one of these preparations to replenish his stock he had to provide himself with the ingredients and then make the preparation himself.

And this was no easy task, as will be seen.

To make oil of earthworms, the formula of that time called for two pounds of earthworms, six ounces of wine and three pounds of olive oil, all of which were to be cooked together until all moisture was

removed and the earthworms were then strained out and the oil bottled for use. This preparation was used externally for rheumatism and gout, and when rubbed on the loins or on the lumbar regions was supposed to relieve suppression of the urine and stone in the bladder.

It was also applied as an antidote to the bites of poisonous animals.

There was another oil of earthworms made by destructive distillation of the worms (heating them in a closed vessel), which yielded an evil-smelling liquid which was given internally as a vermifuge, antispasmodic and anodyne, and was administered in hysteria, epilepsy and nervousness.

The dose was several drops given on sugar morning and evening. It was also used externally.

This same "empyreumatic" oil was used in preparing the Spirit of Earthworms, which was made by impregnating ammonium carbonate with the oil and then dissolving it in water and filtering. This preparation was administered for cramps and colic in doses of from ten to sixty drops, mixed with a suitable liquid. On account of the volatility of the ammonia it was always administered cold.

The vinous spirit of earthworms was another preparation made by the following procedure:

Six pounds of earthworms were first pounded in a mortar and then allowed to stand for a number of days in a well-closed glass vessel until they had decomposed and a strong ammoniacal odor was evident.

This putrefying mass was then infused in six pounds of whiskey and subsequently distilled.

This procedure produced a weak ammoniacal spirit with a disagreeable odor, which was administered in doses ranging from ten to forty drops, diluted with water or wine and employed in lethargic, epileptic and hysterical conditions.

It certainly has been a boon to humanity in more ways than one, that some of the esteemed animal remedies of the past are no longer prescribed.

Emil L. Boerner, Deceased—A graduate of the Philadelphia College of Pharmacy (1876), first Dean of the Department of Pharmacy of the State University of Iowa, died recently at his home in Iowa City.

He was the proprietor of a retail pharmacy for fifty-seven years, and was a prominent member of state and national pharmaceutical associations. In recognition of a lifetime of service passed in the advancement of the pharmaceutical profession, he was honored on December 15, 1932, by his friends and associates of Iowa City and the state at a dinner. A portrait of him, painted by Mrs. Louis Pelzer for his former students in his early classes, was presented to the university at the banquet.

Born in the province of Westphalia, Germany, April 21, 1855, Doctor Boerner came to the United States with his parents in 1857, who located at Newtown, Pa., later moving to Iowa City, where after graduation from his Alma Mater, he spent a lifetme of honorable service in the interests of his fellow men.

Drug Institute Organized—Formation of the Drug Institute of America, Incorporated, through which all divisions of this two billion dollar industry will unite in an effort to end destructive and cutthroat competition, was announced today. Supported at the outset by leading manufacturers, distributors and retailers in the field, it will strive for the objectives outlined by President Roosevelt in his industrial recovery program and in his recent address before the Chamber of Commerce of the United States.

Patterned somewhat along the lines of the American Iron and Steel Institute and the American Petroleum Institute, the new organization for the drug industry will pledge its members to work together and with the Government and other public agencies for their common good. Its aims include the maintenance of a high standard of products, control of output to prevent overproduction, maintenance of fair profits and fair wages, elimination of unfair competition and price cutting and protection of the public in purchasing drug products. It will endeavor to follow the President's suggestion for a "partnership in planning."

Appointment of a directing counsel, who will have the chief direction of the policy of the Institute, under its council representative of the entire industry, and who will be invested with broad powers to carry out its program, will be announced shortly. Incorporation papers have been filed in Albany and temporary executive offices have been opened at 80 Broadway, New York City.

The membership of the Institute will be drawn from the following divisions of the industry:

1. Manufacturers of pharmaceutical, drug and chemical products.
2. Manufacturers of trade-marked medicinal products.
3. Manufacturers of toilet articles.
4. Manufacturers of cosmetics.
5. Manufacturers of other products, generally distributed through the drug trade.
6. Service wholesalers dealing in products generally handled by drug stores.
7. Mutual and other wholesalers dealing in products generally handled by drug stores.
8. Chain retail drug stores.
9. Independent drug stores.
10. Other retail outlets handling products in the drug, toilet or cosmetic fields.
11. Officers and employees of trade associations connected with the drug industry.
12. Deans and members of faculties of Colleges of Pharmacy, and officers of pharmaceutical associations, and members of learned, scientific, public or professional organizations.

The board of directors will include twenty representatives of the various divisions of membership, eight elected from the membership at large and one from outside the active membership.

Caloric Value of Beer—Beer differs considerably in composition. The following figures are representative for seven types of beers, the averages of about 600 analyses being used.

Lusk, in his book "Science of Nutrition," states that a liter of German beer contains from 3 to 4 per cent. alcohol, yielding 450 calories to the body, of which one-half approximately are derived from alcohol and the rest from protein-like extractives and from dextrin.

Beer may be expected to contain, in addition to its alcohol content, from 5 to 7 per cent. of solid matter or extract; from 0.5 to 0.7 per cent. of nitrogenous substances, some of which are protein; from 1 to 2.5 per cent. of sugar as maltose; from 2 to 4 per cent. of gums and dextrins; from 0.16 to 0.4 per cent. of acid as lactic acid, and from 0.15 to 0.36 per cent. of ash. Fat, as such, may be considered absent.

A pint of beer will provide approximately 250 calories. These calories are derived from the chief ingredients as follows: protein or organic nitrogen compounds, 12 calories; carbohydrates, 70; organic acids, 6, and alcohol, 108.—(*Jour. A. M. A.*)